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Isolation and Purification of Thiamine Binding Protein from Mung Bean

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Thiamine has fundamental role in energy metabolism. The organs mostly sensitive to the lack of thiamine levels in the body are the nervous system and the heart. Thiamine deficiency causes symptoms of polyneuritis and cardiovascular diseases. Because of its importance in the metabolism of carbohydrates, we need to measure the levels of thiamine in the body fluids by using an easy and inexpensive way without compromising the sensitivity and selectivity. An option to it is thiamine measurement based on the principle of which is analogous to ELISA, in which a thiamine binding protein (TBP) act by replacing antibodies. The presence of TBP in several seeds have been reported by previous researchers, but the presence of TBP in mung beans has not been studied. This study was aimed to isolate and purify TBP from mung bean. The protein was isolated from mung bean through salting out by ammonium sulphate of 40, 70, and 90% (w/v). TBP has a negative charge as shown by cellulose acetate electrophoresis. The result obtained after salting out by ammonium sulphate was further purified bymeans of DEAE-cellulose chromatography and affinity chromatography. In precipitation of 90% of salting out method, one peak protein was obtained by using affinity chromatography. The protein was analyzed by SDS PAGE electrophoresis. The result of SDS PAGE electrophoresis showed that TBP has a molecular weight of 72.63 kDa.

Key words: chromatography, electrophoresis, mung bean, thiamine, thiamine binding protein (TBP)

INTRODUCTION

Thiamine is an important water-soluble vitamin which takes part in glycometabolism in the body. It has been used for the prevention and treatment of beriberi, neuralgia, Wernicke's encephalopathy, and Korsakoff's syndrome (Carpenter 2000; Eitenmiller *et al.* 2008). Thiamine deficiency is frequently seen in alcoholics because heavy drinking limits the ability of the body to absorb this vitamin from foods (Narouzi *et al.* 2010). Dietary sources considered to be primary sources to the human include fortified breakfast cereals, legumes, nuts, and meat. Recommended Dietary Allowances (RDA) as set by the Institute of Medicine in the Dietary Reference Intake (DRI) for thiamine are 1.2 mg/day for adult men and 1.1 mg/day for women (Eitenmiller *et al.* 2008). Clinically, thiamine status is indicated by measurement of urinary excretion of thiamine and erythrocyte transketolase activity. Therefore, the determination of thiamine is one of the important contents in food and clinical analysis.

Several methods have been already reported for the quantitative determination of thiamine in food and clinical analysis, including spectrophotometry (Chen & Tian 2010), spectrofluorimetry (Moore1 & Dolan 2003), chemiluminescence (Du *et al.* 2002), high-performance liquid chromatography (Anyakora *et al.* 2008), and electrochemical method (Eitenmiller *et al.* 2008). In all these methods, the most common methods used are high performance liquid chromatography, spectrofluorimetry, and spectrophotometry.

The high performance liquid chromatography method used to determine thiamine has high sensitivity, good selectivity, and the ability of simultaneous multicomponent determination. All of these methods require special equipment and high costs for the measurement of thiamine.

Therefore in this research will develop a measurement technique that utilizes thiamine binding protein (TBP) from mung bean base on principle analogous to the ELISA (Enzyme Linked Immunosorbent Assay) in which a thiamine binding protein act replace antibodies. ELISA is a popular serological test which is used as a diagnostic tool in medicine to detect the presence of a substance. ELISA technique is based on the recognation of antibody specifically against an antigen. This technique does not require expensive equipment, just by using a spectrophotometer, do not use radioactive materials, and require a relatively short time.

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Thiamin-binding proteins (TBP) are widely distributed in plants and accumulated in seeds (Watanabe *et al*. 2004). TBP have been isolated from *E. coli* (Iwashima *et al.* 1971), egg yolk (Muniyappa & Adiga 1981), egg white (Muniyappa & Adiga 1979), rice (Shimizu *et al.* 1996), buckwheat (Kozik 1995), sesame (Watanabe *et al.* 2003), wheat (Adachi *et al*. 2000), maize (Adachi *et al*. 2001), and sunflower seeds (Watanabe *et al*. 2002). Their molecular mass, subunit structures, and amino acid composition differ. Also, the optimum pH for thiamin-binding activity and the affinity for thiamin analogs differ.

Mung been is widely known as one source of vitamin B1 (Escott & Stump 2008). Mung beans are popular beans in Indonesia, therefore the mung bean is easily obtained and the price is relatively inexpensive. This raises the question of whether mung bean contain proteins that capable of binding thiamine specifically (TBP). If this is true, then the mung bean can be used as an alternative source of TBP that can be developed for measuring thiamine levels with engineering *enzyme-labeled protein ligan binding specific assay* which is analogous to the ELISA assay.

MATERIALS AND METHODS

Mung bean (*Phaseolus radiatus*) were purchased from department store. We used organic mung beans from local farmers and already in sterile packaging for trafficked. Ammonium sulphate, KH_2PO_4, Na_2HPO_4, NaCl, acrylamide, N,N'-bisacryl, SDS, ammonium persulphate, TEMED, Tris-HCl, BSA, blue brilliant Coomassie, thiamin hydrochloride was purchased from Merck (IND), DEAE-Cellulose resin from Sigma (USA), NHS- Activated Separopore® 4B-CL resins from Bioworld (USA), Dialysis tubing cellulose membrane from Sigma-Aldrich (USA), Titan gel from Helena laboratories (Texas), and molecular weight protein marker from Biorad. All other chemicals were of analytical grade. Protein was assayed according to Bradford with bovine serum albumin as a standard.

Protein Extraction. Mung bean mashed with blender until smooth and then filtered with a size of 150 R (mung bean powder). To 10 g of mung bean powder was added 100 mL of 50 mM potassium phosphate buffer (pH 7, containing 1% NaCl) mixed well using stirer slowly for 24 hours at 4 °C. All operations were conducted at 4 °C. Homogenates were centrifuged at 28,000 x g for 15 minutes. Ammonium sulphate was added to the supernatant to 40, 70, and 90% saturation (Rosenberg 2005). The suspension was left for 1 h and centrifuged at 28,000 x g for 15 minutes. The resulting precipitate was dialyzed against 50 mM potassium phosphate buffer (pH 7, containing 1% NaCl). All the fractions isolated by ammonium sulphate incorporated into dialysis membrane (Rosenberg 2005). Fraction that will dialysis put into membrane and dialysis using 0.01 M potassium phosphate buffer (pH 7). Dialysis process is considered complete if the sulfate concentration in dialysis buffer is zero.

Protein Assay. Protein was assayed following the method of Warburg-Christian (λ 280 nm) and Bradford with bovine serum albumin as a standard (Rosenberg 2005).

Cellulose Acetate Electrophoresis. A set of electrophoresis tools prepared. Helena buffer was poured into positive and negative chamber until the filter paper submerged. Titan (III) cellulose gel immersed in a container that contains a buffer Helena for 20 minutes. Gel that has been soaked, then dried with filter paper. Each wells completed of 7 µL the sample solution of proteins P40, P70, P90, and filtrate. The samples applied as quickly as possible into the gel. After the last sample has been applied waited for 4 minutes to allows the sample to diffuse into the gel. The gel placed into the inner section of the chamber, cellulose side down, by gently squeezing the gel into place. Position the gel so that the edges of the cellulose are in the buffer and the application point is on the cathodic (-) side. The cover placed on the chamber and insure that the cover does not touch the gel. Electrophorese the gel at 180 volts for 15 minutes.

DEAE-Cellulose Chromatography. To 18 g of resin was swelled in 65 mL distilled water for 45 minutes in room temperature. At the end of this periode, the supernatant was decanted and the resin was treated extensively according to procedure described by Sigma. Briefly, the resin was washed repeatedly with great volume various solution containing salt, NaOH and HCl. Before using, the difference of pH between the resin and the solution should not exceed 0.15. The resin was poured carefully into a 30 x 1.5 cm column. Then, 50 mM potassium phosphate buffer (pH 7) was added onto the gel until the flow was stable ($A_{280} = 0$). Two mL filtrate from the dialysis bag were placed onto the gel. The bound protein were eluted firstly with phosphate buffer (pH 7). Fractions of 2 mL were collected and A_{280} was read (Ahmed 2005).

If the $A_{280} = 0$, the 2nd elution was made by adding potassium phosphate buffer (pH 7) containing 10 mM NaCl. The fraction collection continued until A_{280} gave a constant value. The elution continued

progressively with potassium phosphate buffer (pH 7) containing 15, 20, 30, and 40 mM NaCl. Fractions forming peak were pooled for the further analysis.

Affinity Chromatography. Thiamine is immobilized on to NHS- Activated Separopore® 4B-CL. For 20 mL NHS-Activated Separopore medium, 10% (w/v) thiamin hydrochloride was added drop by drop on to stirred medium suspension. Then the free sites of medium were blocked by addition ethanolamine. After free washed with large of 0.1 M Tris buffer (pH 8), then 2 mL of peak fraction in DEAE-cellulose column was put on NHS- Activated Separopore® 4B-CL column and eluted with 0.1 M Tris buffer (pH 8). The active fraction of 1 mL were collected and A_{280} of each fraction was measured when the absorbance was 0, the column washed again with the same buffer. After the washing, buffer containing 1 M NaCl was added onto column and the fraction of 1 mL were collected (Dennison 2002). A_{280} was measured and each fraction was pooled.

Crude protein, precipitate of 90% ammonium sulphate, second peak of DEAE-cellulose column at 90% saturation, and second peak of NHS- Activated Separopore® 4B-CL column at 90% saturation was runned in SDS-PAGE 10% together with molecular weight marker protein and BSA. The gel was coloured by Coomasie brilliant blue solution. The molecular weight of TBP was determined by interception of each Rf with a curve of made from molecular weight marker protein.

RESULTS

Three saturation of 40, 70, dan 90% obtained from salting out by ammonium sulphate. Each saturation of 40, 70, dan 90% dialyzed to remove ammonium sulphate. Protein was measured at at a wavelength of 280 nm with bovine serum albumin as a standard (Table 1).

Cellulose Acetate Electrophoresis. Saturation of 40, 70, 90%, and filtrat was analyzed to determine the protein charge of each sample. Protein band in 90% saturation was thicker than other protein band and has negative charge (Figure 1).

Precipitate with 40, 70, and 90% saturation of ammonium sulphate, followed by DEAE-cellulose

Table 1. Total protein concentration after dialysis

Sample protein	Protein concentration (mg/mL)
40% saturation	9.60
70% saturation	5.10
90% saturation	2.50

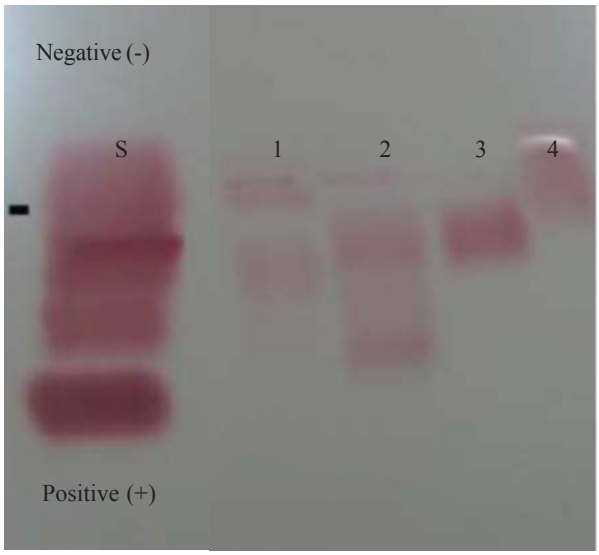

Figure 1. Cellulose acetate electrophoresis of protein from mung bean. S: Serum, 1: Presipitat 40%, 2: Presipitat 70%, 3: Presipitat 90%, and 4: Filtrat.

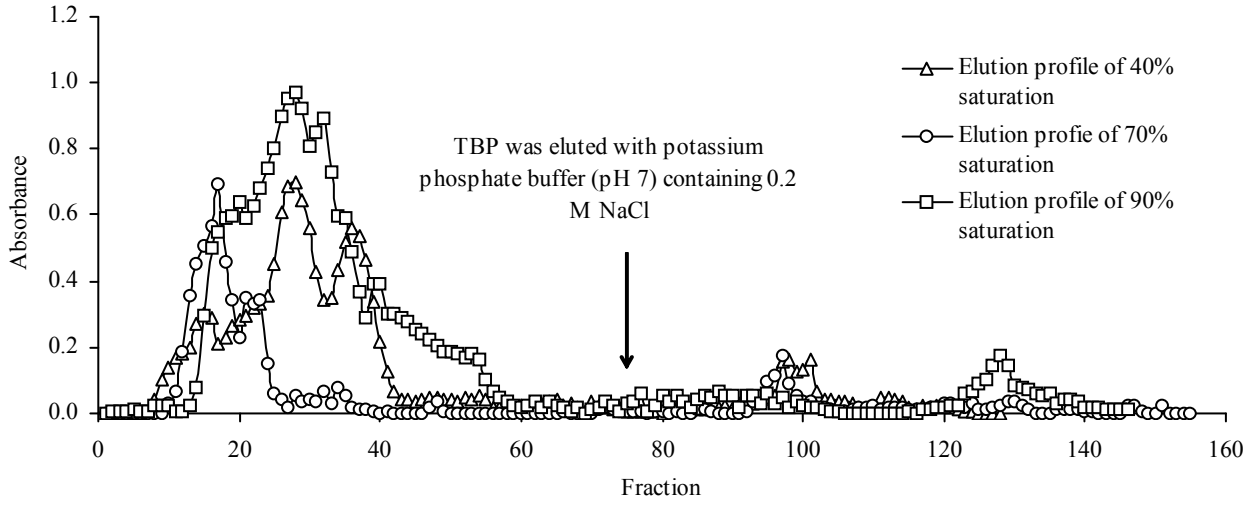

Figure 2. Elution profile from a DEAE-cellulose column.

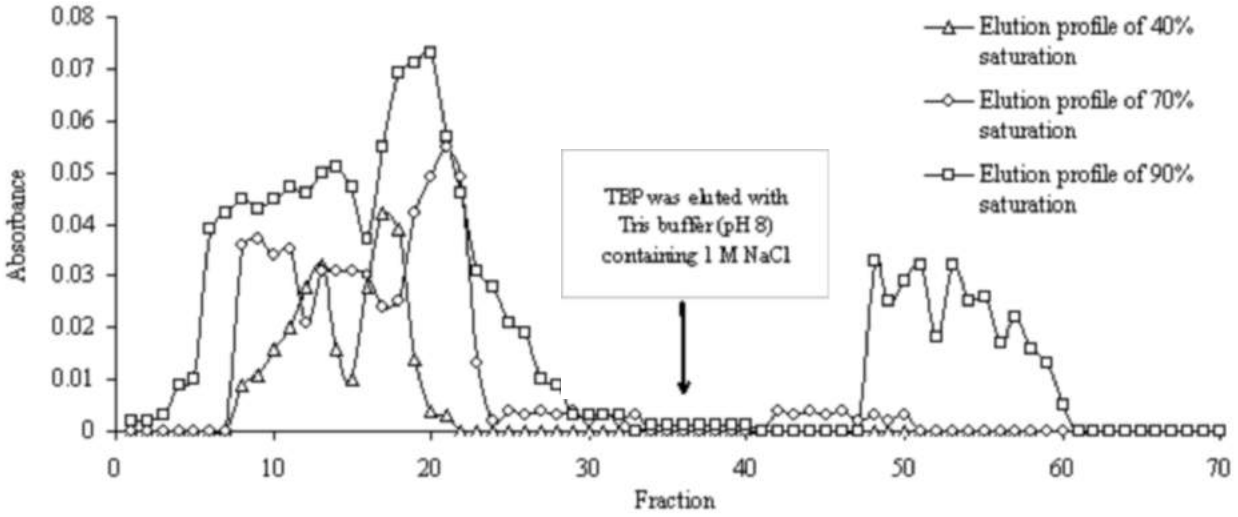

Figure 3. Elution profile results of affinity chromatography.

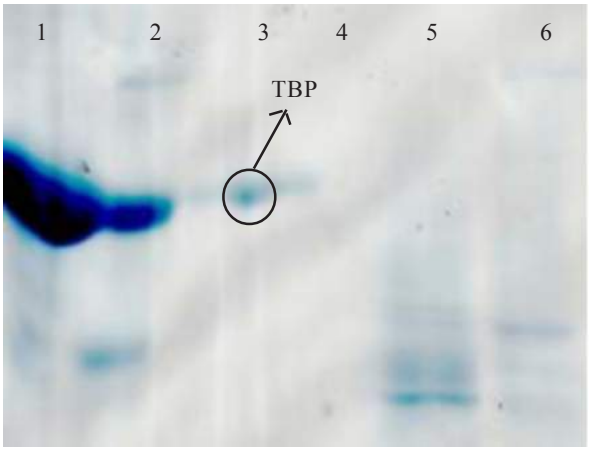

Figure 4. SDS-PAGE of TBP from mung bean. Well 1: Bovine serum albimine, 2: marker protein, 3: peak protein of 90% saturation by affinity column, 4: peak protein of 90% saturation by DEAE-Cellulose column, 5: 90% saturation by ammonium sulphate, 6: crude protein of mung bean.

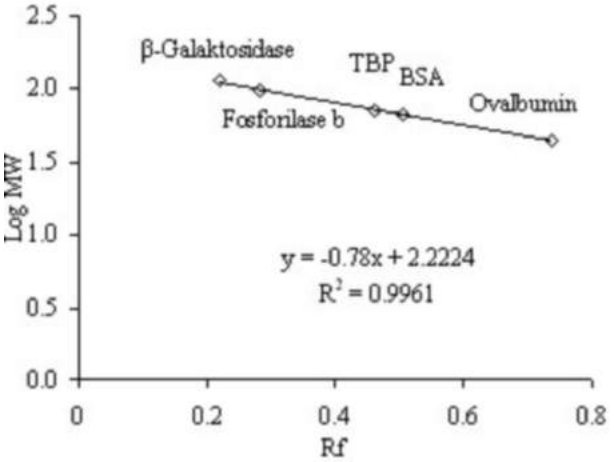

Figure 5. Molecular weight (MW) estimation of TBP from mung bean by SDS PAGE.

chromatography. To obtain the TBP in pure state, we proceeded an affinity chromatography method.

DEAE-Cellulose Chromatography. Thiamin is positively charge in neutral pH, therefore the TBP should have a relatively negative charge. Two peak protein was obtained using DEAE-cellulose column chromatography (Figure 2). In the DEAE-cellulose the first peak eluted from the column usually have positive charge and TBP with negative charge will eluted by potassium phosphate buffer containing 0.2 M NaCl. Because that, we purified second peak fatherly by passing them in affinity chromatography column. Each second peak of DEAE-cellulose was passed in the affinity column in separate experiment.

Affinity Chromatography. Two peak protein obtained by affinity chromatography of 90% saturation (Figure 3). The first peak from affinity column has protein which unbound thiamin. Whereas the second peak from affinity column has only the pure TBP. On the other hand, only one peak protein unbound thamin by affinity chromatography of 40 and 70% saturation (Figure 3). The purity of obtaining TBP was showed by single spot in SDS-PAGE analysis (Figure 4). From this technique, we could estimate the molecular of TBP. Molecular weight TBP can be calculated by entering the Rf value of 0.46 into the standard curve equation (Figure 5). The results of the calculation of molecular weight proteins bind thiamine obtained for 72.63 kDa. TBP obtained by concentration of 34 µg/mL (Table 2).

DISCUSSION

Thiamin is necessary for human and animal nutrition. TBP may enhance the nutritive value in plant seeds. TBP have additional functions such as

Table 2. Purification of thiamine binding protein from mung bean at 90% saturation

Purification step	Total protein (µg/mL)
Extract	70103
Ammonium sulfate	6845
Dialysis	2500
DEAE-cellulose	67
NHS-Activated Separopore® 4B-CL	34

retention of thiamin in dormant seeds and provision of a nitrogen source at germination (Watanabe *et al*. 2004). In this research to isolate TBP from mung bean, respectively, using ammonium sulfate salts with a saturation of 40, 70, and 90%, followed by purification by DEAE-cellulose ion exchange chromatography and affinity chromatography.

The early stages of purification was centrifugation. Pellet was dissolved with 0.05 M potassium phosphate pH 7. Protein deposition is done by addition of ammonium sulfate at different concentrations. Concentration of protein obtained at this stage can be seen in Table 1. Dialysis is carried out on the next step to eliminate the salt ammonium sulphate from each presipitate. The TBP has negative charge, this is evidenced by doing an analysis of cellulose acetate electrophoresis. These results are supported by Adachi *et al.* (2001) research that TBP from maize seed had negative charge.

Purification continued by ion exchange chromatography method using resin DEAE celullose. In this process there will be competition between proteins with Cl^- that have negative charge equally bound to matrix DEAE celullose that have positive charge (Bonner 2007). Every precipitate from this stage showed 2 peak protein, the first peak is positively charged protein and the second peak is composed of negatively charged proteins (Figure 2). Protein levels for 90% saturation at each purification steps are shown in Table 2.

To obtained pure TBP, each peak of negative protein from DEAE cellulose chromatography was separated by affinity chromatography techniques. NHS-Activated Separopore@4B-CL used as resin affinity chromatography. Thiamin hydrochloride used as ligand which binding TBP on affinity column, although TBP from plant seed bind only free thiamin not thiamin phosphates (Watanabe *et al*. 2003). Thiamin which has positive charge would bound with TBP of mung bean. TBP was eluted with 1 M NaCl solution. At this step, TBP obtained by concentration of 34 µg/mL (Tabel 2).

The level of purification is analyzed by SDS-PAGE electrophoresis technique. The molecular mass of TBP from mung bean was estimated to be 72.63 kDa using SDS PAGE (Figure 4, 5). The TBP from rice germ, sesame seeds, buckwheat seeds, maize seed, wheat, and sunflower seeds differ in their structural, biochemical, and immunological properties. The TBP from rice germ has a molecular mass of 50 kDa on the SDS-PAGE (Shimizu *et al*. 1996). The TBP from wheat germ has a molecular mass of 56 kDa (Watanabe *et al*. 2003). The TBP from maize seed has a molecular mass of 96 kDa (Adachi *et al.* 2000). The TBP from sunflower seed has a molecular mass of 46 kDa (Watanabe *et al*. 2002) and TBP from sesame seed has has a molecular mass of 17 and 19 kDa (Watanabe *et al*. 2003).

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Exploring Indonesian EFL Students' Reading Strategies for Economics Texts

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Abstract

The present study aims to explore the types of Indonesian EFL students' strategies to comprehend the economics texts. To identify the types of strategies, retrospections and reading comprehension tests were adopted and analyzed. The results revealed that most students with a low level of English proficiency remained more dependent on the bottom-up strategies than top-down strategies. However, using the bottom-up strategies had facilitated the students comprehend the economics texts. Thus, in spite of its limitation, the study has some implications to ESAP reading in EFL classrooms.

Key words: ESAP, reading comprehension, EFL, retrospection, bottom-up strategies, top-down strategies

Introduction

Most Indonesian EFL students at a university level are provided a course of reading comprehension for *English for Specific Academic Purposes* (ESAP). This is very imperative because university students have to read journals and other references related to their courses. In order to be able to read academic texts in ESAP, EFL students are required to have reading strategies skills (Nuttall, 1982). They are expected to be skillful readers who have the same reading competence as skillful native readers. Skillful readers, unlike unskilled readers, can apply more strategies more effectively (Barnett, 1988). Moreover, EFL students at the faculty of economics are requested to understand "the subject-context" expressed in English (Jordan, 1997). These conditions become bearers for most EFL students because of their poor strategies and low level of English proficiency. Yet, they should study ESAP courses, such as reading economics texts as one of the compulsory courses determined by the faculty. Very few studies, however, have examined EFL students' strategies to deal with this problem. Therefore, an empirical study needs to be conducted in order to understand how EFL students cope with their problems and how to develop their reading strategies.

Students' Reading Strategies for Comprehension

In the reading literature, some researchers have affirmed that reading strategies have positive impacts on comprehension. Rusciolelli (1995), who conducted a study with college Spanish students, found that skimming, for example, proved most useful strategies to students. She identified that the subjects could comprehend a text better by using skimming compared to re-reading. The finding may suggest that skimming as the top down strategy is more helpful than re-reading as the bottom-up strategy. Similarly, Carrell (1991), who investigated the strategy employed by the subjects of two groups: at lower proficiency and higher proficiency levels, found that the subjects with higher proficiency level who invoked global strategies, such as activating background knowledge and recognizing text organization comprehended texts were more successful than the subjects with lower proficiency level who used the bottom-up strategies, such as focusing on grammatical structures and word meaning. The results of the above studies, however, appear to be still suggestive rather than definitive because there is also evidence from another study revealing that students at high proficiency level in a foreign language still make use of the bottom-up strategies.

Alderson (1984, p.20) strongly remarked in his study that "proficiency in the foreign language was more closely associated with foreign language reading ability and thus reading problems are due to language problems of that language." In other words, EFL students with a low level of English proficiency may not be able to use reading strategies such as predicting and hypothesizing.

Laufer & Sim (1985) provided strong supports to the importance of the foreign language proficiency for EFL reading. Similarly, Davis & Bistodeu (1993), who investigated whether L1 and L2 reading processes were different from the subjects of native readers of French and English, supported to the threshold hypothesis. They found that the foreign language itself had a powerful impact on the psychological processing during L2 reading and the low level of linguistic proficiency resulted in much greater attention to the bottom-up strategies. On the other hand, Li & Munby (1996), who conducted their study with EFL students with a high proficiency level in English, found that the students kept translating to comprehend a text. Findings of these studies are still contradictory and remain questionable whether good readers or poor readers invoked the top-down, the bottom-up or both strategies. The evidence may trigger further study on what strategies invoked by EFL students at a university level to comprehend academic texts as a part of ESAP. Therefore, a further study is still needed to identify what types of reading strategies for comprehension invoked by EFL students, and this study attempted to investigate this problem focusing on EFL students with a low proficiency level in Indonesian setting.

Methods

Research Design

This study was designed to explore what reading strategies were invoked by Indonesian EFL students. They were given reading strategy questionnaires, called *retrospection*, and *short answers reading comprehension test.*

Subjects

The respondents were students who took English for ESAP, particularly reading comprehension. Before taking ESAP, they had learnt General English (GE). However, their language proficiency was still at below threshold level—their TOEFL scores at the range of 350-400.

Instruments

This study used two types of instruments: *Reading comprehension test with short answers* and *Retrospection*. The first instrument was a *reading comprehension test* with some questions related to the main idea, supporting ideas, inferences, and patterns of paragraphs. These questions could elicit to what extent the students' responses were accurate. To respond these questions, the subjects were requested to provide short answers as their responses to the given questions. After they responded to the given questions, they were asked to explain ways or strategies used when reading the texts. This type of obtaining students' responses was called *Retrospection* as the second instrument of the study. Retrospection is one of the verbal reports used as a means of gaining insight into the reading process in the mind of a reader; therefore, it is very useful for giving insight into strategy used in reading. Some researchers suggest that there are ways in which retrospective verbal reports can be significant to provide insightful and valid data. For example, Cohen (1986, p. 133) state that "retrospection can be immediate (e.g. within, say an hour of the reading) or delayed (a few hours, days or even a week after the reading). This is supported by Dhieb-Henia (2003, p. 393) who argues that "immediate retrospection, which is completed directly after reading task, ensure that the subjects' short-term memory can be accessed and its content reported, yet guarantees a minimum of interference with the reading process." In the present study, the immediate retrospection was applied to obtain insights into reading strategies for identifying the main idea, making inferences, and recognizing patterns of paragraphs.

Data Analysis

The data from the retrospection and the reading comprehension test were collected and analyzed qualitatively through some procedures. First, the data were classified into several types of reading strategies. In this method, the researcher carefully read the retrospection for possible codes or categories relevant to the aim of the study. Second, some reading strategies invoked by the students were analyzed to assess the accuracy of answering given questions, as some previous researchers also remarked that there were apparently relations between certain types of reading strategies and successful or unsuccessful EFL reading (Pani, 2004). In the current study, the "accuracy" refers to the ability of the subjects to identify the main idea and supporting ideas, to make inferences, and to recognize the patterns of paragraph.

Results

The data from the retrospections were classified into some types of reading strategies for (1) identifying the main idea, (2) making inferences, and (3) recognizing patterns of paragraphs. After classifying the types of strategies invoked by the students, the accuracy of comprehension was presented.

1. Types of Reading Strategies for Identifying the Main Idea

When the students were asked what reading strategies were used for identifying the main idea, they informed that they used similar bottom-up reading strategies such as, *reading sentence by sentence, re-reading, translating, recognizing cohesive devices* and *using a dictionary* for identifying the main idea. Some used *webbing; and few used washing plus reading sentence by sentence.* Nevertheless, the results of the analysis of the students' accuracy were low. For example, less than 50% of the students were able to identify the main idea accurately by using *translating* and *reading sentence by sentence* strategies. 28% of them could identify the main idea accurately by using *cohesive devices* as the bottom-up strategy and using *cohesive devices plus webbing* as the interactive strategy. Only 12 % could identify the main idea correctly by using *webbing plus reading sentence by sentence* strategies.

2. Types of Reading Strategies for Inferences

When the students were asked the strategies used for inferences, they informed that they employed the bottom-up strategies: *reading sentence by sentence, re-reading, translating, paraphrasing, and using cohesive devices.* Some used *webbing* and *webbing plus sentence by sentence or re-reading*.

The analysis of the accuracy in drawing conclusions revealed that 30% of the students could make inferences accurately. When using *cohesive devices*, and *webbing plus cohesive devices*, most (70%) students were able to draw conclusion accurately.

3. Types of Reading Strategies for Patterns

The two bottom-up strategies, *paraphrasing* and *reading sentence by sentence,* were invoked by most students for recognizing patterns of paragraphs. A few made use of *cohesive devices* as the other strategy. With regard to accuracy, the results revealed that 25 % of the students could recognize the organization of the paragraph correctly by *paraphrasing, re-reading* or *translating*, while 75 % of the students employed *cohesive devices* for recognizing the organization of the paragraph.

Discussion

The results revealed that EFL students invoked some types of reading strategies which were effective and ineffective for their comprehension. The retrospective data indicated that the strategies, starting from the most to the least frequent strategies: *reading sentence by sentence, re-reading, translating, using cohesive devices, paraphrasing, webbing,* and *using a dictionary*.

The first most frequent strategy was *reading sentence by sentence.* As one of the students, *Mai* (pseudo name), said:

(1) "I read the paragraph sentence by sentence, understand the meaning of each sentence, and then go on reading till the end of the sentence of the paragraph. After that, I look for a main idea of that paragraph." (Mai)

The second most strategy was *re-reading*. One of the students, *Yen*, said:

(2) "I read the whole text more than twice and make inferences by figuring out what the author actually wants to convey the message in the text."(Yen)

The use of these two strategies would obviously be due to the attempts to think deeply the content of the text before making inferences. However, this strategy did not help the students identify the main idea and make an inference.

The third most strategy used by the students was *translating.* In this strategy, the students translated the English text literally (word by word or sentence by sentence) into Indonesian, as seen in the following data:

(3) "I read the text and translated word by word directly so I understand what I read and identify a main idea of a paragraph." (Yan)

This is the common strategy employed by Asian EFL learners. As Liu and Littlewood, in Meyer (2012, p. 246), contrast Western with Asian students' learning strategies, arguing that Asian students incline "to focus on

individual word meanings and grammar points removed from context," while Western students make use of "contextual clues" for comprehension. On the basis of the retrospection (3), there are two plausible explanations why the students used *literal* translation to understand the text. For one thing, this strategy was used because the students tried to understand the exact meaning of each word and sentence and important facts of the text. For another, the strategy was used to identify the main idea since the text is too difficult, or the topic of the text is unfamiliar to the students. Because of the difficulty and unfamiliarity of the text, they had to read the text slowly while translating it if they had not yet understood it. As a result, these impediments make the students unable to identify the main idea and make an inference accurately.

The fourth frequent strategy invoked by the students was *using cohesive devices* such as, *references, word repetitions, synonyms* and *conjunctions.* One of the students stated,

(4) "In order to find out a main idea, first I identify the references which lead us to find out the topic noun and the topic sentence. From the topic sentence, I can identify what the main idea of the paragraph is. As for supporting ideas, I identify sentences which support the main idea." (Her)

References serve a number of purposes. Firstly, they are used to avoid boring repetitions and can provide enriching information about the antecedent (word being referred to). Secondly, they are usually used to connect meaning units and ideas in texts and to present new information in each subsequent sentence. Another cohesive device was *word repetitions.* Like references, the same words might be also often repeated by the author to construct coherence. The next cohesive devices were *synonyms*. The students felt that recognizing the synonym in the text could help them guess the meaning of words in the text and understand the meaning relation in the text.

The fifth strategy used by the students was *paraphrasing*. This strategy refers to readers rephrasing and reproducing the content of L2 text using words in L1 language. There are some ways of paraphrasing chosen by the students. They reproduced some contents, important facts, or just the main idea (e.g., a claim) and supporting ideas (e.g. evidence).One way of paraphrasing was to reproduce some content of the English text by using words in Indonesian, as stated by one of the students:

(5) "The above text describes the movement of the employees. This causes problems . . . The cause is . . . What is needed is . . . On the basis of these facts, we can draw a conclusion." (Eka)

The sixth strategy used by the students was *webbing*. Through webbing, the students are expected to be able to generate key words and to connect them together into a kind of "network" of information in their mind. Farrel (2009) and Sudo and Takaesu (2013) stated that the semantic webbing or mapping could activate students' background knowledge. However, solely webbing strategy did not help the students comprehend texts. This strategy would be effective when it was combined with other bottom-up strategies: *reading sentence by sentence, re-reading,* and *using cohesive devices*, as seen the following retrospection:

(6) "I find out key words related to business (topic). I read all sentences and translate them into Indonesian. Before comprehending the message, I predict the topic of the paragraph and identify its main idea." (Ren)

The data displayed that the student invoked an *interactive process of reading*. First she tried to guess the topic by relating the key words and the topic of the text. After predicting it, she read sentence by sentence (all sentences) and translated them into Indonesian before identifying the main idea. In this strategy, the student obviously made use of the top-down strategy (predicting the topic) and the bottom-up strategy (reading sentence by sentence and translating). However, webbing plus reading sentence, re-reading, and translating strategies did not facilitate the students in comprehending the text in the present study. This finding differed from some previous findings which claim that webbing could facilitate the subjects comprehend the text easily (James 1987; Sayavendra 1993).Yet, one caution for interpretation of these results must be taken into account as it is very possible that the ineffectiveness of webbing to improve the students' comprehension in this experiment is due to the students' low level of foreign language proficiency, and this is in line with the claims that EFL students with a low level of foreign language proficiency may not use reading strategies such as webbing, as good readers usually do when they are reading (Laufer and Sim 1985). It can therefore be claimed that webbing is not effective for the EFL readers with a low level of foreign language proficiency in the present study. The other retrospection also showed the use of webbing plus using cohesive devices, as interactive process, as follows:

(7) "I use a web. First, I predict key words related to the topic of the text. Next, I identify references word repetitions, the topic noun, and topic sentence. Finally, we can recognize a main idea of the paragraph." (Sri)

The above retrospection suggests that webbing is used only to activate the readers' knowledge related to the topic of the text. Having the relevant topic, they could identify the key words which were considered to be related to the references, the topic nouns, and the topic sentences. When webbing was combined with cohesive devices, it was effective. Accordingly, these results strongly confirmed that the cohesion plus webbing strategy could help the students comprehend the text.

The *least* strategy used was *using a dictionary*. This finding reaffirms earlier study (Hulstijin, Hollander, and Greidanus 1996), suggesting that ESL/EFL students seldom use the dictionary when reading a non-fictional text such as academic texts in order to understand the main idea. As one of the students, *Fen*, stated,

(8) "I try to read the whole text in order to get a main idea. Then if I find out some unknown words or vocabulary I try to guess the meanings of those words from the context. I will look up them in a dictionary if I really do not understand the meanings of them."(Fen)

The data showed that the student realized that looking up new words in a dictionary, while reading, would slow down her reading and interrupts her thinking. As a result, she only guessed the meaning of words from the context. However, there are some serious pitfalls in guessing if students' language proficiency is low. Referring to Hynes' study, Celce-Murcia and Olshtain (2000) stated that EFL students could guess the meaning of words accurately only when the context provided them with immediate clues for guessing. If the context clues are not recognized by them because of their low level of foreign language proficiency, they might lead to misinterpret the meaning of words and consequently misunderstand the text. Therefore, students are encouraged to occasionally double-check their guesses by using the dictionary.

Conclusion

The study showed that Indonesian EFL students used more the bottom-up strategies than the top-down strategies. The types of bottom-up strategies used were *reading sentence by sentence*, *re-reading, translating, using cohesive devices* and *using a dictionary*, while top-down strategies were *webbing*. Interestingly *webbing plus sentence by sentence* was also invoked by the students though the strategy was ineffective. By contrast, when *webbing* was combined with *cohesion*, this strategy was effective. Thus, these results may suggest that Indonesian EFL students with a low level of English proficiency rely on their linguistics knowledge when they read economics texts. However, they are ready to be trained to develop their reading strategies if they are given the explicit teaching of top-down and bottom-up simultaneously as the result also revealed that they could employ webbing plus sentence by sentence and cohesion.

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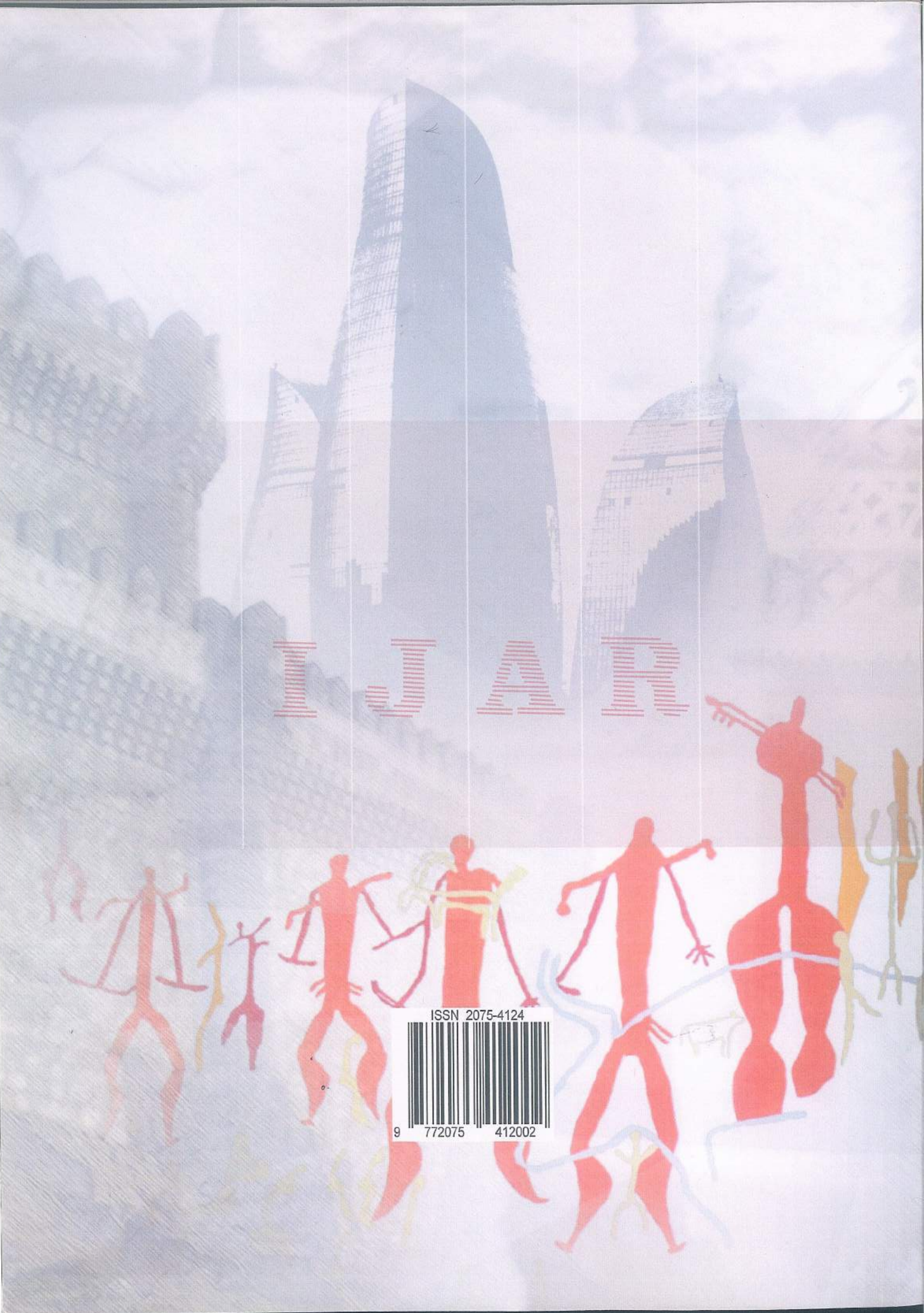

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PART B. SOCIAL SCIENCES AND HUMANITIES

IMPROVING EFL STUDENTS' READING COMPREHENSION THROUGH COHESIVE DEVICES AND WEBBING INSTRUCTIONS

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ABSTRACT

English for Academic Purposes courses requires EFL students to be familiar with the grammatical structures and much of the vocabulary, and they are expected to comprehend English authentic texts. Problem may arise; however, when the students are not skilled and have a low level of English proficiency. For this reason, the present study aims at investigating how the cohesion, webbing, and cohesion plus webbing could improve the EFL students' reading comprehension. To conduct this research, some students were randomly selected and assigned into four groups: one control and three experiments. After the treatment, the collected data of pre-and post-tests scores were analyzed by using t-test and f-test. The results strongly suggest that the Indonesian EFL students with a low level are (1) highly sensitiveof cohesion, (2) heavily dependent on the bottom-up reading process, and (3) able to use interactive reading process after they were instructed the cohesion plus webbing. In spite of its limitation, the study offered suggestions to EFL language teachers in implementing the explicit instruction of cohesion and webbing before reading activities.

Key words: Cohesive devices, Webbing, EAP, EFL, Reading Comprehension

1. INTRODUCTION

In Indonesia, particularly at a university level, such as the faculty of economics which provides Indonesian EFL students a course of English for Academic Purposes (EAP), reading English texts is considerably very essential for some reasons. First, English, as foreign language, is not used as a medium of instruction and daily communication in and outside classes. Next, the Indonesian EFL students at the faculty of economics are requested to read English books and journals related to their subjects or courses. Third, reading English texts is often the only available exposure for EFL students to the target language. These situations suggest that there is a need for reading comprehension courses in English, especially EAP with the aim at providing EFL students with skills needed to meet their English reading requirements for their academic courses.

The problem is that most Indonesian EFL students at university are not skilled and have a low level of foreign language proficiency [1]. Therefore, an empirical study must be made in order to facilitate how Indonesian EFL students with a low level of English proficiency can cope with their problems. One of the ways to assist them is providing an instruction of cohesion, webbing, and cohesion plus webbing which is conducted in this study.

2. COHESION

The concept of cohesion which is coined by [2] refers to meaning relation occurring within texts. The existing cohesive elements, as devices, can make the texts coherent, which means that the texts hang together. As [3] states that "for a text hang coherent it must be cohesive; ...." In this sense, cohesive devices are considered as the essential factor in making the text coherent.

Several studies have revealed that understanding cohesive devices is crucial for EFL/EAP students because the cohesion knowledge can facilitate the students comprehend the texts. As [4] who analyzed English Business and Economy (EBE) texts, showed that cohesive devices were frequently used in the EBE text. Based on the finding, she suggested that teachers should include cohesion in the curriculum and teaching of reading comprehension. Another study was conducted by [4] who examined the cohesive performance of practiced and unpracticed of Malaysian students. He found that unpracticed readers, who were exposed to only in their native Malaysian tongue, found difficult to understand both grammatical and lexical cohesion and comprehend the meaning relations between sentences because of their inability to comprehend sentence connectors. Next, [5] investigated the reading threshold needed for EAP texts and found that grammatical cohesion was one of the most important element for understand the EAP text. Similarly, [6] who made the study of the effect of discourse markers on comprehension of lectures found that both markers could facilitate the understanding of the lecture. Arecent study also revealed that lexical cohesion plays an important role in both spoken and written comprehension [7].

The above lines of researches have confirmed the importance of cohesive devices in reading comprehension. These lead to the need of instruction of cohesive devices to EAP students in the classroom. While a small number of the investigations of the cohesive devices instructions have done up to date, this present study is an attempt to investigate the effect of cohesive devices instruction on EFL students' comprehension of economics texts.

3. WEBBING

The web is originally associated with a network of fine threads that a spider weaves. In language teaching and learning, it represents the relation between a concepts or objects which can be used to activate readers' background knowledge related to the content of the text. According to [8], "webbing is used as flexible instructional strategy at all instructional level." Webbing, like maps, can be applied in the classroom teaching from elementary schools to colleges or

university. As a teaching instruction, webbing can promote comprehension since it permits the new to related to the known, and builds personal involvement with texts.

As [9] offers some steps in creating web. A teacher starts writing the topic of the reading passage on the board, and then asks students what they have known about the topic and what they want to know. They are asked to write their answers on the board around the topic to generate a web. After generating many words related to the topic, students are requested to organize the web into major topics and subtopics. At last, the topics, major topics, and subtopics are put into some kinds of a logical order, such as collection of description, cause & effects, and comparison & contrast. The concept of webbing is sometime also called mapping, is believed to be a useful instruction to activate or empower students' experience or background knowledge related to the content of a text [10[11].

Some previous studies related to webbing have been conducted by several researchers. [12], for example, remarked the value of semantic webbing in the pre-reading instruction to prepare EFL/ESP students for the reading of texts. She further suggested that the webbing instruction could make readers' awareness of devices. Similarly, [13],[10] and [11] stated that the semantic webbing or mapping could activate students' background knowledge. They suggested that teachers related various concepts and key words surrounding particular topic on the board and helped students clearly see the possible relationships between the ideas or concept discussed.

All previous studies on webbing mentioned above showed that webbing could be used to activate students' background knowledge related to the topic of texts being discussed so that they can comprehend the content of texts very well. However, a few questions still remain whether the webbing instruction is effective for EFL students who have a low level of English proficiency. This present study attempt to investigate to what extend the webbing instruction can improve the comprehension of EFL students with a low level of English proficiency.

4. COHESION PLUS WEBBING

In the reading research, particularly in ESL/EFL, there have been debates among researchers concerning the role of language background knowledge, such as cohesive devise, and background knowledge which can be activated through webbing activity. On the one hand, some researchers, such as [14], [15],[16], [17] who used the top-down approach as the basis of their studies claimed that using top-down methods of instruction had indeed strong effects on students' reading comprehension. On the other hand, other researchers, such as [18] and [5], who applied the bottom-up approach, had also affirmed that language knowledge had significant effects on students' reading comprehension.

It seems that all the above studies have not yet been conclusive and definitive, but suggestive. This may imply that in order to understand reading texts, researchers have to examine the possible effect of both language and background knowledge because there must be a kind of interaction of linguistics knowledge, such as vocabulary or cohesive devices and background knowledge, like the experience and familiarity of topic of texts being read. For this reason, the present study also aims at finding out the impact of the combining cohesion and webbing (cohesion plus webbing) instruction on EFL students' reading comprehension with a low level of English proficiency.

In the light of the above review of some related literatures, it is hypothesized that the cohesive devices, webbing, and cohesive plus webbing instructions will be better than no instruction of cohesive, webbing, and cohesive plus webbing, in particular:

H1: EFL students would comprehend English economics texts better when cohesion instruction is given than no cohesion instruction.

H2: EFL students would comprehend English economics texts better when webbing instruction is given than no webbing instruction.

H3: EFL students would comprehend English economics texts best when cohesion plus webbing instruction is given compared to merely webbing or cohesion instruction.

5. METHODOLGY

On the basis of the literature review discussed above, this study aimed at finding out the impact of instructional cohesion (COH), webbing (WEB), and cohesion plus webbing (COH+WEB) on Indonesian EFL students' comprehension of economics texts as their EAP course at the university.

6. RESEARCH QUESTIONS

Some research questions are addressed as follows:

1. Can *COH* instruction improve EFL students' reading comprehension?
2. Can *WEB* instruction improve EFL students' reading comprehension?
3. Is *COH+WEB* instruction better than *COH* or *WEB* in improving EFL students' reading comprehension?

7. RESEARCH DESIGN

This study was designed as an experiment, consisting of four groups—COH, WEB, COH+WEB, and Control (C) groups.COH group was given cohesive devices instruction, WEB webbing instruction, COH+WEB cohesive devices plus webbing instruction. As for C group, no instruction of cohesion and webbing, but they were provided texts along with some exercises every sessions. Prior to and after the treatment, all groups were given the reading comprehension test. Thus, there were three independent variables and the reading comprehension as the dependent one.

8. SUBEJCTS

The subjects of the study were students of the faculty of economics. There were 160 students who were assigned into four groups. They took English for Academic Purposes (EAP). Prior to study at the university, they had learnt general English when they were at senior high schools. But their language proficiency was still relatively at low level. Out of the total number of students, 75 percent had TOEFL scores at the range of 350-400.

9. MATERIALS

All selected materials for instruction or treatment and per-and post-tests were adapted from a textbook designed by the researcher, namely Business English for EFL Students of the Economics Faculty [19] and articles or journals of economics. On the basis of these materials, the assessment was conducted to see the extent to which the subjects' awareness and skills of webbing and cohesion improved.

10. PROCEDURES

The procedures of the study cover the process of instruction as the treatment, instruments, and data analysis.

11. INSTRUCTIONS

The procedures for the presentation of the instructions were similar, except for the control group. The instructions began with arousing the students' interest, activating background knowledge (webbing instruction), linguistic knowledge (cohesion instruction), and combining cohesion and webbing instruction.

The cohesion instruction and the webbing instruction each took about 90 minutes, sixty minutes for cohesion and webbing explicit instruction and thirty minutes for exposure or exercises. The combining cohesion plus webbing also took 90 minutes—sixtyminutes for cohesion and webbing explicit instruction and thirty minutes for exposure or exercises. The instruction were based on a lesson plan which was set up by the researcher with the purpose of providing a clear direction of what the instructors were going to teach the students.

12. INSTRUMENTS AND ANALYSIS

The reading comprehension test was constructed and designed for the pre-test and post-test. The pre-test was used to obtain the base line data of the subjects' reading comprehension skills. The post-test which also indicated whether the subjects had made significant progress after they had been instructed was used as the inferential comprehension variable. Both the pre- and post-tests consisted of three passages with multiple choices form and shorts answers.

The pre- and post-tests scoreswere analyzed using a One-way ANOVA (analysis of variance) because of several assumptions. First, there was one dependent variable (scores of the pre-and post-tests reading comprehension), and one independent variable with four levels: cohesion, webbing, cohesion*webbing, and control. Thus, the comparisons were made in only one direction. Second, the data were independent (not-repeated-measures), meaning each subject contributes one score to only one group, and the comparison was between groups. Third, the data in the respective populations from which samples were drawn were normally distributed.

At last the quantitative data were analyzed by using the Paired Sample t-test in order to find out the effect of each instruction on reading comprehension, and the Post Hoc Test was performed to locate differences among means.

13. RESULTS AND DISCUSSION

The results of the analysis are presented in in the following sections:

14. EFFECT OF INSTRUCTIONS

The effects of the four instructions: cohesion, webbing, cohesion plus webbing andcontrol on reading comprehension to the COH, WEB, COH+WEBand C groups are analyzed by using the t-test. The statistic tests are used to examine if the post-test scores of reading comprehension are better than the pre-tests or in other words to find out whether there are significant improvement of the instruction on students' reading comprehension. To examine the improvement, the scores of the pre- and post-tests of reading comprehension collected from thefour groups were compared and analyzed.

The results of the t-tests for the four groups are elaborated as follows: first, the result of Paired Samples t-test for the controlinstruction on reading comprehension to the C group revealed that the mean scores of the pre-test (M=11.68) were higher than the post-test (M=10.58). A further t-test (Table 2) revealed that the observed value of t was 1.638. This value did not meet or exceed the critical value of t-table (2.226). Thus, the t-test was to, 025, 39 = 1.638 < 2.226, meaning that the observed value of t was extremely far from the critical value of t. The Sig.(2-tailed) of approximately 0.109 exceeding the alpha 0.05 (Sig = 0.109 > 0.05) strongly suggested the acceptance of the null hypothesis, stating no different mean scores between the pre- and post-tests of the reading comprehension. Therefore, these results strongly confirmed no significant effect of the control instruction: the traditional teaching of reading (no treatment of cohesion or cohesion plus webbing in the pre-reading activity) did not improve the students' reading comprehension.

Table 1. Means of the pre-and post-test scores for the control group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.68	40	2.912	.460
POST TEST	10.58	40	3.889	.615

Table 2. Paired samples t-test for the control group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	1.10	4.247	.672	-.26	2.46	-1.638	39	.109

Second, the result of Paired Samples t-test for the Cohesion instructionon reading comprehension to the COH group revealed that the mean score (the second column of Table 3) of the pre-test (M=11.60) was smaller than the post-test (M=14.95). A further t-test revealed that the observed value of t was 5.479 (table 4). This value was greater than the critical value of t (2.026). So the t-test was to, 025, 39 = 5.479 > 2.026, meaning that the observed value of t was absolutely greater

than the critical value of t. The P-value of approximately 0.00 which was lower than the alpha 0.05 (Sig = 0.00 < 0.05) strongly suggested the acceptance of the hypothesis (H1), stating that students would comprehend the text better when the cohesion teaching was given than no cohesion teaching was given. Therefore, these results evidently verified a significant effect of the cohesion treatment: the explicit instruction of cohesive devices in the pre-reading activities could improve the students' reading comprehension.

Table 3. Means of the pre- and post-test scores for the COH group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.60	40	3.028	.479
POST TEST	14.95	40	3.046	.482

Table 4. Paired samples t-test for the COH group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-3.35	3.867	.611	-4.59	-2.11	-5.479	39	.000

Next, the result of Paired Samples t-test for the Webbing treatment on reading comprehension to the WEB group revealed that mean score (Table 5) of the pre-test (M=11.10) was more or less the same as the post-test (M=11.65). A further t-test revealed that the observed value of twas 0.941 (Table 6). This value did not meet or exceed the critical value of t (2.226). Thus, the t-test was to, 025, 39 = 0.941 < 2.226, meaning that the observed value of t was lower than the critical value of t-test. The P-value of approximately 0.353 exceeding the alpha 0.05 (Sig = 0.353 > 0.05) suggested the acceptance of the null hypothesis (H0), stating that there was no significant effect of webbing on reading comprehension. Therefore, these results strongly confirmed that the explicit teaching of webbing in the pre reading activities did not help the students improve their reading comprehension.

Table 5. Means of the pre-and post-test scores for the WEB Group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.10	40	2.889	.457
POST TEST	10.63	40	3.094	.489

Table 6. Paired samples t-test for the WEB Group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-.53	3.530	.558	-1.65	.60	-.941	39	.353

At last, the result of Paired Samples t-test for the Cohesion plus Webbing treatment on reading comprehension to the E3 group revealed that the mean score (Table 7) of the pre-test (M=11.80) was higher than the post-test (M=19.00). A further t-test revealed that the observed value of t-test was 13.970 (Table 8). So the result of the t-test was to, 025, 39 = 13.970 > 2.022, meaning that the observed value of t was absolutely greater than the critical value of t. The P-value of approximately 0.00 which was lower than the alpha 0.05 (Sig = 0.00 < 0.05) strongly suggested the acceptance of the hypothesis (H3), stating that students would comprehend the next better when the cohesion plus webbing was given than no teaching of cohesion plus webbing. Thus, these result strongly confirmed the significant effect of the cohesion plus webbing: the explicit instruction of cohesive devices plus webbing in the pre-reading activities could help the students improve their reading comprehension.

Table 8. Means of the pre-and posttest scores for the COH+WEB group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.80	40	2.972	.470
POST TEST	19.00	40	2.470	.391

Table 8. Paired samples Test for the COH+WEB group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-7.20	3.260	515	-8.24	-6.16	13.970	39	.000

From the results of t-test analysis presented in Table 1-8, the significant differences in mean scores of the four groups were statistically obvious. These results, however, did not pinpoint where the significant differences lied and raised more questions: *Was the mean of the C group different from the COH group? Was the mean of the C group from the WEB group? Was the mean of the C group different from the COH+WEB group? Were all the four means different?* To respond these questions, the *Post-hoc test* was conducted and the results are presented in Table 9.

Table 9 indicates that the mean scores between that two experimental (*COH* and *COH+WEB*) groups and the control (*C*) group were significantly different. These result confirmed that were indeed the significant effects of the cohesion and cohesion plus webbing teaching on reading comprehension in the *COH* and *COH+WEB* groups. But it also shows that the mean scores between the other experimental (*WEB*) group and the control (*C*) group were not statistically significant. These results did not support to the hypothesis two stating that the webbing teaching had affected reading comprehension in the *WEB* group. These significant differences in mean scores between the *COH*, *WEB*, and *COH+WEB* group and the *C* group required further elaboration.

Table 9. Post Hoc Test

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Class C	Class COH	-4.38 (*)	.708	.000	-5.77	-2.98
	Class WEB	-1.05	.708	.140	-2.45	.35
	Class COH+WEB	-8.43 (*)	.708	.000	-9.82	-7.03
Class COH	Class WEB	3.32 (*)	.708	.000	1.93	4.72
	Class COH+WEB	-4.05 (*)	.708	.000	-5.45	-2.65
Class WEB	Class COH+WEB	-7.38 (*)	.708	.000	-8.77	-5.98

**The mean difference is significant at the.05 level*

The *COH* group mean difference was listed as 4.38 which was higher than the mean of the *C* group, and the asterisks (*), indicating a significant difference at the level.05, was displayed next to it. These result suggested that the subjects who received the teaching of the cohesive ties had better post-test scores than the subjects who did not receive it. These results strongly confirmed the significant effect of the cohesion treatment on reading comprehension: providing knowledge of the cohesive devices to the students before reading could improve their reading comprehension.

The *WEB* group mean difference was 1.05 which was absolutely low and not statistically significant compared to the mean of the *C* group. This insignificant result implied that the subjects who received the webbing treatment did not have better post-test scores than the subjects who did not receive it. Thus, the evidence verified no significant effect of the webbing on reading comprehension: only providing webbing treatment to the students in the pre-reading did not improve reading comprehension.

The third experimental (*COH+WEB*) group mean difference was 8.43. This result was apparently higher than the mean of the *C* group and statistically very significant. These substantial results suggested that the subjects who received the webbing plus cohesive ties treatment had better scores than the subject who did not receive it. Thus, these findings strongly confirmed the significant effect of cohesion plus webbing treatment on reading comprehension: providing knowledge of cohesion devices combined with webbing before reading could improve reading comprehension.To recapitulate, the *Post-hoc test* strongly confirmed the significant effects of the cohesion and cohesion plus webbing treatment but insignificant effects of the webbing and traditional (control) treatments on reading comprehension.

15. DISCUSSION

In the light of the above analysis, some major results are discussed further and used to respond the research questions.

RESEARCH QUESTION NUMBER ONE

Can COH instruction improve IndonesianEFL students' reading comprehension?

The result of the *post-hoc test* and *paired-sample test* for the COHgroups revealed thatthe cohesion instruction strongly confirmed that the cohesion instruction can improve the students' reading comprehension. The result provided the evidence to the importance of the cohesive devices to EFL students. The finding suggest that recognizing and understanding the cohesive devices, such as references, word repetitions, conjunctions, and synonyms, are very essential for readers because these devices signalize the story line of a story which facilitates the readers comprehend the text better. For example, being aware of cohesive devices could make readers easy to identify the topic sentence and the organization of paragraph, such as description, cause & effect, comparison & contrast. Thus, the findings lend to support some previous claims stating that cohesive devices play a vital role in reading comprehension, and understanding them can facilitate readers to comprehend texts ([4], [20],[21]). The finding also implies that the EFL students in this study relay on their linguistics background knowledge, meaning that they have to read sentences by sentence and to understand meanings of words by words. These reading strategies, called a bottom-up strategy, may normally be employed by the EFL students at a low level of English proficiency. It is obvious that the explicit instruction how to recognize and identify cohesive ties is the essentially helpful for the students to comprehend economics texts. This finding endorses strongly a number of studies which have indicated that explicit teaching of linguistic elements can facilitate and improve EFL students' reading comprehension ([22], and [23]..

RESEARCH QUESTIONS NUMBER TWO

Can WEB instruction improve Indonesian EFL students' reading comprehension?

The result of the *post-hoc test* and *paired-sample test* for the WEB groups indicated thatthe webbing instruction cannot improve the students' reading comprehension though the mean score of the students in the webbing group was higher than the students in the control group who did not receive the webbing teaching. There are possible reasons why the webbing instruction was not effective in this study. For one thing, the webbing instruction seems to be discrete linguistic items into a coherent whole by using their background knowledge. For another, it is possible that the students' background knowledge does not match with the content of the text because the influence of the background knowledge is not predictive, but rather, selective. This means that there are possibilities of mismatch between the background knowledge and the content of the text though the students had been provided key words or concepts related to the topic of the texts in the webbing instruction before reading. The result do not endorse to the top-down approach which asserts that readers will successful in comprehending a text if their background knowledge or schemata related to the topic of the text is activated through top-down strategies, such as webbing which are supported by [14] and [15]. By contrast, the result supports the assertion that it would be disadvantageous for EFL readers if they rely too heavily on the top-down approach [21]. In this study, the webbing instruction is not effective in helping the students' comprehension.. This finding is similar to the current research which revealed that semantic mapping as cognitive strategy or top-down strategy could not increase EFL students' vocabulary acquisition significantly [24]. These results may suggest that EFL students whose English proficiency at below threshold levelmay not be able yet to employ a cognitive strategy, like mapping or webbing.

RESEARCH QUESTIONS NUMBER THREE

Is COH+WEB instruction better than COH or WEB in improving Indonesian EFL students' reading comprehension?

The result of the Post-hoc test and paired-sample test for the *COH+WEB* group showed that the combined cohesion webbing instruction strongly confirmed that there was indeed a significant effect of the cohesion plus webbing on the students' reading comprehension. The result suggested that webbing could be effective in improving the subjects' comprehension if it was combined with the cohesion. One of plausible reason is that by using the combined webbing and cohesion the students utilized both webbing, as a top-down strategy, and cohesion, as a bottom-up strategy. When the student invoked the webbing strategy they predicted the tittle or topic of the text and identified the key words related to the topic. After predicting the topic, they confirmed their prediction and understanding by reading and paying attention to the cohesive ties, such references, conjunctions, and synonyms as guidance to comprehend the content, such as the main idea and important facts. This finding strongly confirms that interactive reading process exists, meaning that readers employ simultaneous process of both bottom-up and top-down strategies. As [25] suggests that pre-teaching difficult words, such as cohesive ties, make EFL students feel easy to have in their academic reading, and activating appropriate schemata, such as webbing to relate the content to their prior knowledge can facilitate them to comprehend the academic texts. Thus, at the top-down processing, readers draw on their prior knowledge and reading experience; while at the bottom-up processing, they retrieve their language knowledge, such as cohesive devices in order to decode the text.

16. CONCLUSION AND IMPLICATION

On the basis of the analysis and discussion of the findings, some conclusions are drawn to respond the three research questions. First of all, the cohesion instruction was generally quite effective. The result strongly suggested that the cohesion instruction could help the EFL students with a low level of English proficiency or below threshold level to comprehend the economics texts. Two point, at least, worth making. The first point is that understanding the cohesive devices can help the student process meaning at the inter sentential level. To read texts at this level, the students have to perceive links between sentences ([20]; [26]; [20]; [21]). The second point is that understanding cohesive ties lead to the students to comprehend the organization of texts, such as description, comparison & contrast, cause & effect, and problem-solution.

Secondly, the webbing instruction could not improve significantly the EFL students' comprehension of the economics texts as it proved somewhat ineffective and had only a week effect. The webbing instruction might put the EFL students at a disadvantage since they have not had the top-down strategy experience yet, and they tend to relay on the bottom-up strategy such as reading sentence by sentence and translating meaning of word by word. In this respect, they had to waste their time and failed to understand the meaning relations which are often signalized by cohesive devices.

Finally, the combined cohesion and webbing instruction was the most effective way to improve the EFL students' reading comprehension. The finding suggested that the students made use of webbing as the initial stage to gist key words related to the topic. After understanding the topic, they paid attention to cohesive devices which guide them to identify cohesive ties, topic sentence in order to find out the main idea and important facts or details. Obviously, the result provided supports to the assumption that reading process involves two aspects—bottom-up and top-down strategies which interact simultaneously ([27]; [21]). In particular, the study lend support to the assumption that the EFL students with at a low level results in much greater attention to the bottom-up component of comprehension, such cohesive devices, but they could invoke the webbing when it was combined with the cohesion instruction.

The study has implied that the findings could be generalized to other students with the same qualification due to its limitation of in-depth nature of the analysis and of a large number of subjects. However, there are some implications to EFL teachers. Cohesion and cohesion plus webbing instructions in the pre-reading activity offer a promising option for foreign language teachers to use in helping students read English texts, particularly the economics texts as one field of EAP. Powerful effects of understanding cohesive devices are very obvious in the present study when these devices are combined with webbing instruction. Webbing can train students activate their prior knowledge related to the topic of texts. Through webbing, students are encouraged to hypothesize and predict what message conveyed by an author. After making hypothesis, students can confirm it and read texts by employing the bottom-up strategy---paying attention to cohesive devices.

Obviously, the role of the cohesive devices in making sense of a text apparently suggests that EFL/EAP teachers can be encouraged to instruct or to train their students, who are below the threshold level, to understand the cohesive devices in order to compensate the lack of their language knowledge and to help them cope with their difficulties in comprehending the academic texts. Teachers can provide a variety of exercises that make students could sharpen their awareness of the need to keep checking, as they read texts, that they have interpreted cohesive devices in a way that make sense in the context of the text. The study also revealed that cohesion instruction, as the bottom-up strategy, can be effective if it was implemented with the instruction of webbing, as the top-down strategy; therefore, when teaching cohesion the teacher may consider webbing. In this case, they do not only improve students' foreign language knowledge but also help them activate their background knowledge so that they have an ability to predict and hypothesized the context or the topic of texts.

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TAILOR-MADE TEACHER STRATEGIES AND PEER ASSESSMENT FOR EFL WRITING

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ABSTRACT

This study aims to find out the impact of a tailor-made teacher strategy for enhancing students' self and peer assessment. Ten students working towards their Master Degree in teaching of English participated in this study. One of the compulsory courses in this programme is Academic Writing. Within six sessions, they were assigned to write drafts of paragraphs within their own subject areas. They then self-assessed their paragraphs following an explanation by the teacher on how to write a good paragraph. Finally, each paragraph was assessed by their peers. In addition, they were requested to complete self and peer assessments. After analysing the data, the results revealed that the EFL students responded positively to the self and peer assessment which was facilitated by a specific strategy designed by the teacher which is contradictory to the argument that most EFL students mistrust feedback given by their peers.

Key words: tailor-made teacher strategy, self assessment, peer assessment, EFL, paragraph writing

1. INTRODUCTION

The role and effectiveness of teacher assessment, self assessment and peer assessment in language teaching and learning, particularly in EFL contexts, remain challenging for researchers and teachers. The principle that underlies teacher assessment is that of a teacher-centred approach; whereas, self and peer assessment form a learner-centred education [1]. It is clear that in teacher assessment, all tasks and procedures are set up by a teacher, but in self and peer assessments, students are involved in not only providing self and peer feedback but also in developing cooperative learning [2].

As procedures in the learning process, self and peer assessments offer some benefits for learners. First, self and peer assessments can develop students' higher-order thinking because they are challenged to be creative. Next, self and peer assessments can encourage learners to collaborate with their peers because they are required to assess and provide feedback to others. More importantly, self and peer assessment may develop learners autonomy because they can prompt students to monitor their own learning.

In spite of their advantages, Nelson and Murphy [3] study revealed that most EFL students prefer teacher assessment to self and peer assessment. This preference may be due to a number of reasons. First, for some decades, teaching methodology in Asian countries, including Indonesia, has exposed students to a teacher-centred education. Next, traditionally the students have believed in the superiority of their teachers [4]. Third, some scholars question whether in typical classroom conditions 'students have the ability to conduct self assessment and use its feedback for text improvement' (5].

A number of previous studies have been conducted in this area. Lam [6] investigated the extent to which self, peer and tutor assessments were related to student perception and text revision. Lam found that EFL learners tend to incorporate both peer and teacher feedback. Thus, he stressed the important role of self assessment in text revision. Zhao [7] investigated the effectiveness of teacher intervention strategies on peer assessment of Chinese EFL writing and found that vigorous and continual teacher support of peer assessment significantly affected learners' perceptions of its value.

However, most of these studies were carried out in ESL and EFL undergraduate programmes, which differ from those of post-graduate programmes in a number of ways, such as the scope, time available and the students' proficiency level. Therefore, a further study is still needed for EFL learners in other contexts.

2. RESEARCH METHODS

Research questions

Based on the review of related literature, the research questions are addressed:

1. Can Indonesian EFL students develop their paragraph writing through a tailor-made teacher strategy and self and peer assessments?
2. What are Indonesian EFL students' perceptions of a tailor-made teacher strategy for self and peer assessments?

Research design

The study which was conducted over seven sessions was designed to develop EFL students' academic writing through a tailor-made teacher strategy and peer assessments. The study aims to find out to what extent a teacher's support can enhance a value of students' self and peer assessment in the writing course.

Research context

There were ten participants who studied in a Master programme at a Department of English Language Teaching in Indonesia. Most of the participants had been English teachers for more than three years; a few were recent graduates with a teaching degree. However, their academic writing was still at below threshold level. They took the course because to write their term papers and thesis in English as a requirement for achieving a Master degree.

Tailor-made Teachers' strategies for peer assessment

Tailor-made strategies are specifically designed by a teacher for the particular purpose of enhancing the quality of peer assessment. These particular supportive strategies for peer assessment include three major essential steps.

The first step is called the activating of students' background knowledge. In the process of activating their background knowledge, the students are requested to select any sentence on any topic they choose and to develop it into a well-formed paragraph by utilizing their knowledge of linguistic tools.

The second step is the developing of the students' knowledge of the concept of writing a good paragraph. In this part, the teacher explains how to write a good paragraph with the goal of providing the students with the concept of paragraph. For example, the teacher describes a good paragraph as having unity, containing one main idea only and should coherence [8]. Next, the teacher instructs students to work in pairs, to assess their partners' paragraphs, and to give direct or indirect feedback to their peers [9]. While the students engage in peer assessment, the teacher walks around and encourages each student to practise assessing and to provide direct or indirect feedback on his/her partner's work.

The last step is revising the paragraphs by referring to the given feedback. In direct feedback, the partner marks errors and provides the correct form; by contrast, in indirect feedback, the partner only marks errors, but the correct form is not given [10], [11].

Instruments

Two types of instruments were employed in the study: paragraph writing and the self and peer assessment questions. The paragraph was composed by students; and self- and peer-assessment, which was constructed by the teacher, consists of six yes/no questions with a space for comments (see Appendix 1).

Data analysis

This study collected two types of data – the paragraph and the self and peer assessment question. The paragraph writing was analysed in order to find out their development of writing skills. To analyse the paragraph, the unity and coherence criteria were used. To see the improvement of the paragraph, the first drafts of the students' paragraphs were compared with the second drafts. The self and peer questions were analysed to see whether the students had positive or negative perceptions of teacher and peer assessment.

3. FINDINGS AND DISCUSSION

Number of revisions made

Ten students' paragraphs were collected and identified with the number of revisions made after self and peer feedback. The results indicated that there were 38 revisions made by 10 students: 20 revisions of the first draft after self feedback and 15 revisions of the second draft after peer feedback.

Out of the number of revisions on the first draft, factually irrelevant supporting sentences were the most frequent errors; no concluding sentence and ineffective topic sentence were the second most frequent; lack of transition signals to link sentences within paragraphs was the third most frequent; other aspects of coherence, such as content and grammar, were the least frequent.

The revision of the second draft after peer feedback revealed that the lack of transition and pronouns was still present. However, other aspects of paragraph unity, such as irrelevant factual supporting sentences, concluding sentences and verb tenses were not significantly problematic.

The result of the revision after self feedback suggests that the effectiveness of a tailor-made strategy for developing students' knowledge of the concept of writing was significant. By understanding the concepts of unity and coherence, they made their own assessment on their own first drafts, and then the experience of self-assessment was used to assess and to provide feedback to their peers. From peer feedback on the second draft, the revisions were relatively minor; and yet, the aspects of content and grammar no longer seemed problematic for the students.

Revision changes

The types of revisions made by the students are classified into the two main aspects of unity and coherence. The former, which is related to the organization of paragraphs, includes the statement of the topic sentence and closely relevant, factually supporting sentences; the latter concerns the use of key noun repetitions, pronouns (references), content and grammar (see Table 1).

Table 1. Types of revisions

Types of revisions	Example no.	First draft	Second draft
Controlling ideas of the topic sentence (unity)	1	There are some reasons why Muslims should learn Arabic. First, Al-Quran is written in Arabic. Consequently, a Muslim has to understand its content. Second, the Prophet, Mohammad, had commended all Muslims to learn. In conclusion, Muslims should learn Arabic to comprehend his or her religion well.	Muslims should learn Arabic for some reasons. First, Al-Quran is written in Arabic. This makes Muslims must have a good proficiency to understand its content easily. Furthermore, the Prophet, Mohammad, commanded all Muslims to learn Arabic. In conclusion, Muslims should learn Arabic to comprehend their religion well.
Irrelevant factual supporting sentences (unity)	2	Graduate students learn quantitative and qualitative research to prepare them in writing journal, proposal, and thesis. The lecturers are very cooperative and helpful because they support their students to ass the course as soon as possible; as a result, the students will begin writing proposal in the first semester. Although writing proposal and thesis needs more effort, the students are motivated to try it.	Students learn quantitative and qualitative research methodology. Quantitative research is confirmatory or "top-down", while qualitative research is exploratory or "bottom-up." A form of final report in quantitative research is statistical report (e.g. with correlations, comparisons of means, and reporting a statistical significance of findings0; nevertheless, a form of final report in qualitative research is narrative report with contextual description and direct quotations from research participants. Both quantitative and qualitative researches are very useful for students in writing thesis.
Key noun repetition, references	3	Teacher, as one of professions, is the most challenging task for me. First of all, we must have much knowledge for our students. Second, we have to be creative in teaching learning process. Next, the teachers have to know many kinds of	Teacher, as one of professions, is the most challenging task for us. First of all, we must have much knowledge for our students. Second, we have to be creative in teaching learning process. Next, we have to know many kinds of methods, many strategies, many materials that used in supporting teaching learning

		methods, many strategies, many materials that used in supporting teaching learning process. Finally, the teacher is like a conductor in concert, who have to make harmony of many different instruments.	process. Finally, we are like a conductor in concert, who have to make harmony of many different instruments.
Content (coherence)	4	West Sumatra has many kinds of famous foods. For example is Rendang. Other example are KripikBalado and IkanBilis. Many people come from other cities who want to know about West Sumatra.	West Sumatra has many kinds of famous foods. First, the famous food is Rendang. Many people like to eat Rendang, even they are from other cities. Also they can make it by themselves at home if they want to eat it. Second, people like to eat "KripikBalado." For example, people who come to West Sumatra like to buy it as their gift to their family and friends. Third, Bilis fish is a delicious fish that comes from Singkarak lake. Many people who want to eat those fish when people come to West Sumatra.
Grammar (verb tenses, subject–verb agreement) (coherence)	5	There are 3 activities in reading strategies. First, reading activities is intended to construct background knowledge, so the students know about a concept or content a particular text. Second is while reading activities. The aims of this stage are to help students to understand the specific content and to perceive the rhetorical structure of the text. The last is post-reading activities. It is intended to verify and expand the knowledge acquired in the reading, and it leads the learners to discuss and analyze issues that presented in the reading. In brief, pre-reading, while-reading, and post-reading are important activities in reading classroom.	There are 3 activities in reading strategies. First, reading activity is intended to construct background knowledge, so the students know about a concept or content a particular text. The second is while reading activity. The aims of this stage are to help students to understand the specific content and to perceive the rhetorical structure of the text. The last is post-reading activity which is intended to verify and expand the knowledge acquired in the reading, and it leads the learners to discuss and analyze issues that presented in the reading. In brief, pre-reading, while-reading, and post-reading are important activities in reading classroom.

In the first example, the first revision type concerns the controlling idea – some reasons – of the topic sentence, which is written in an ineffective way in the first draft: There are some reasons why Muslims should learn Arabic. In the second draft, the controlling idea was revised: Muslims should learn Arabic for some reasons. The revision of the topic sentence makes it easier for a writer to develop the unity of a paragraph, and at the same time it makes it easier for a reader to predict what factual information is being used to support the controlling idea. This finding implies that the students implicitly quiet understand the importance of the controlling idea in a paragraph. This awareness might be due to the impact of self and peer assessment in which students have already learnt the concept of unity and coherence from the peer and teacher.

The second revision is related to the factually supported sentences. In the first draft, the student developed the paragraph with irrelevant supporting sentences. In example two, the student had to jot down specific supporting sentences related to the quantitative and qualitative instead of other facts, such as helpful lectures. But after the tailor-made teacher strategy was conducted, the student was able to develop relevant supporting sentences.

The third revision is the use of key noun repetitions and references to link sentences together. Example three indicates that in the first draft the student employed inconsistent key noun repetitions and references such as, the teacher, the teachers, me, and we. In the second draft, the references us and we are used so that the movement from one sentence to the next is logical and smooth, and, therefore, the paragraph becomes more coherent.

The fourth revision is content. To meet the content criteria, the paragraph adheres to the topic assignment and is thoroughly developed. Example four shows that in the first draft some types of traditional foods are used to explain the controlling idea, which is famous food. In the second draft, several specific and famous foods are developed thoroughly with concrete examples. The data shows the improvement of students' paragraph writing abilities.

The last revision is grammar, particularly the plural forms of nouns and subject–verb agreement. Example five indicates that the student used the singular form, is, for the plural subject, reading activities. Yet, it might happen due to his mistakes instead of errors as seen in the example. He used the correct subject–verb agreement in both the first and second drafts: It leads ... or In brief, pre-reading, while reading and post reading are important activities in reading classroom.

In conclusion, the revisions made by the students might suggest that the tailor-made teacher strategies for enhancing self and peer assessment could develop the ability of EFL students to write paragraphs. This finding is in line with the argument that students should be coerced into a more active through interaction with their teachers, peers and the students themselves [12].

Students' perception of self and peer assessment

The results of the students' perception of self and peer assessments can be summarized as follows:

Most of the students had never been asked to give peer assessment. They commented that by having peer assessment they understood their mistakes. But, two students who had not been asked to give peer assessment commented that up to now the teacher only assessed and provided scores without the involvement of students.

When they were asked whether they trusted their peers when providing feedback, most of them said that they trusted their peers though they kept asking the teacher to correct and check the feedback provided by the peers. A few trusted the teacher because the teacher feedback was clearer than peers. Most of them commented that the teacher feedback was very useful; a few felt it was quite useful.

In short, though most students admitted that they had never been asked to make self and peer assessments, they had a positive perception of self and peer assessment and feedback which is contradictory to the belief that most EFL students prefer teacher feedback to peer feedback because they believed that the teacher had a greater understanding of the subject [13]. Yet it is necessary to note that the educational background of the participants in this study differed from the subjects of Nelson and Murphy's study. The students in this study had BA in English with an intermediate level of English proficiency.

4. CONCLUSION

Self and peer-assessment contribute to the development of students' independence in learning, creative thinking and cooperation. Nevertheless, some researchers remain doubtful of the effectiveness of this formative learning process. This study revealed that the EFL students could, with teacher specific assistance, develop their writing and trust their peers to provide feedbacks. They had also positive perceptions of self and peer assessment and feedback with the understanding

that the teacher continues to facilitate the learning process. Hence, the role of the teacher remains as a facilitator and this motivates students to be active and to cooperate with each other.

This study is limited by the number of participants in the sample as well we by the scope of writing skills to be acquired, Therefore, additional research, particularly in an EFL context, is still needed to arrive at a more comprehensive understanding of the value of self and peer assessment as a formative learning process.

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Infusing Critical Thinking into English Coursebooks

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Though critical thinking has been officially written as one of educational objectives in Indonesia as written in the Regulation of the Republic of Indonesia Number 17 Year 2010 Regarding Educational Management and Administration, it seems that schoolteachers in this country still do not understand what it is and do not realise the importance of critical thinking for students and professionals of this country. This might be because there is no clear conception of what kind of critical thinking needed in education in this country, or it may be because Indonesian schoolteachers do not really know how to encourage students' critical thinking as they may be still confused with this concept as mentioned above. The latest 2013 curriculum, however, seems to have accommodated the infusion of critical thinking into school subjects, as can been seen in the adoption of Bloom's taxonomy. This article therefore attempts to argue what critical thinking can contribute to Indonesian students and people as well as proposes reading activities based on Ilyas' critical thinking framework. This framework is the result of synthesising, examining and evaluating critical thinking taxonomies, strategies, programmes and tests.

Keywords: critical thinking, critical thinking framework, Indonesian education, coursebooks

Meskipun berfikir kritis (critical thinking) telah dimasukan ke dalam salah satu tujuan pendidikan di Indonesia yang tertulis dalam Peraturan Pemerintah Nomor 17 Tahun 2010 Tentang Pengelolaan dan Administrasi Pendidikan, guru-guru sekolah di Indonesia nampaknya belum benar-benar memahami apa itu berfikir kritis dan belum menyadari pentingnya berfikir kritis bagi siswa dan professional di negeri ini. Hal ini mungkin disebabkan tidak jelasnya konsep berfikir kritis seperti apa yang dibutuhkan dunia pendidikan Indonesia, atau mungkin juga disebabkan guru yang belum mengerti bagaimana mendorong siswa berfikir kritis karena mereka sendiri belum memahami konsep berfikir kritis, seperti yang telah disebutkan di atas. Kurikulum 2013 nampaknya telah memasukan berfikir kritis, dengan diadopsinya taksonomi Bloom dalam kurikulum tersebut. Oleh karena itu

artikel ini memaparkan kontribusi berfikir kritis terhadap siswa dan professional Indonesia, juga menawarkan aktifitas membaca dengan memasukan berfikir kritis yang diambil dari kerangka berfikir kritis Ilyas. Kerangka berfikir kritis ini merupakan hasil dari sintesa, evaluasi dan telaah dua puluh taksonomi, strategi, program dan tes berfikir kritis.

INTRODUCTION

Even though critical thinking is an elusive concept, it is believed to be important in this globally changing world, in which humans' lives are bombarded with a stream of information. Not being able to be critical, people could be the victims of misleading information; they also could be manipulated easily. This may be dangerous for society and eventually threaten democracy.

Critical thinking has gained attention in education to address such issues as democracy, tolerance and independence. Besides this, critical thinking can promote deep learning as an alternative approach to what rote learning and memorisation approaches cannot provide. Many countries have included critical thinking in their educational agenda, some of which even have included critical thinking in English textbooks. China, for example, has included critical thinking in English textbooks for university students.

Indonesia has also included critical thinking as one of educational objectives. This is written in the government document: the Regulation of the Republic of Indonesia Number 17 Year 2010 Regarding Educational Management and Administration. The latest school curriculum, the 2013 curriculum, seems to have considered the importance of critical thinking though it is not clear what kind of critical thinking needed in Indonesian education. That critical thinking has gained attention in the newest curriculum can be seen from the adoption of Bloom's taxonomy; Bloom's taxonomy is claimed to be able to promote higher order thinking skills, a similar concept to critical thinking. However, there is no explicit examples for teachers how to promote students critical thinking skills or how teachers can optimise coursebooks to encourage students' critical thinking.

This article attempts to fill the gap between the educational objective and its application in the classroom regarding critical thinking, especially in the teaching of English (ELT). Very little attention has been paid to how critical thinking can be included in ELT, particularly in the Indonesian context. This article argues the benefits of critical thinking and therefore proposes how to infuse critical thinking into reading texts by providing the

examples of critical thinking questions that can be adopted and modified by Indonesian English teachers. It is expected that students can be critical when reading texts; thus, avoiding them to become the victims of texts' propaganda and help them put their own position in this ever-changing world full of 'irresponsible' information.

CRITICAL THINKING

The Importance of Critical Thinking

Critical thinking has been admitted by many authors to have a lot of benefits in various aspects of life and for people coming from different walks of life such as students and professionals (Alfaro-LeFevre, 2003; Bandman & Bandman, 1995; Brown & Rutter, 2007; Cottrell, 2011; Forshaw, 2012; Milos & Hitchcock, 2005; Sharma & Elbow, 2000). It seems to have been a favourite topic of discussion in an academic setting, along with its pros and cons. This may be because there is no agreed definition of critical thinking owing to its abstract concept. Every book presents a different definition, and every author is entitled to define its conception. However, Fisher (2008) argues that "while there may be a problem in definition, nonetheless a focus on teaching thinking has the potential to significantly improve the quality of education for all students" (p. 7).

There are some doubts whether the skills of thinking can be taught or not, but thinking process always happens in human mind in spite of no special training on the skills. All skills, whether they are difficult or not, could be taught and learned, including the skills of thinking. This is supported by Costello (2000) who argues that thinking skills can be taught to not only teenagers or adults but also children. If thinking skills can be taught to children, logically the teaching of the skills to teenagers and adult may be easier as they have more experience and more developed intelligence to reason. This is because adults "have internalized over time a greater quantity of metacognitive information" (Fisher, 2008, p. 9).

If thinking skills can be taught, critical thinking, which is part of thinking skills may also be taught. It means that critical thinking can be improved. Halpern (2014) supports this notion by citing some studies (e.g. Herrnstein, Nickerson, de Sanchez, & Swets, 1986; Van Gelder, 2001) showing that critical thinking can be improved. For example, Herrnstein, Nickerson, de Sanchez, and Swets (as cited in Halpern, 2014) report that based on the evaluation of nationwide thinking skills programme in Venezuela, students participating in the programme had better oral and written argument than those of control group.

As mentioned, many authors believe that critical thinking can have positive impacts on students when applied at school. Regarding the benefits of critical thinking, Cottrell (2011) argues that:

> Good critical thinking skills bring numerous benefits such as improved attention and observation; more focused reading; improved ability to identify the key points in a text or other message rather than becoming distracted by less important material; improved ability to respond to the appropriate points in a message; knowledge of how to get your own point across more easily; skills of analysis that you can choose to apply in a variety of situations. (p. 4).

Cottrell's argument shows the benefits of critical reading activities that are indeed an inseparable part of students' daily lives. Good reading activity is in fact not simply deciphering a text; it involves certain processes such as questioning, analysing, interpreting, concluding and commenting. In questioning a text, a reader can put in mind questions such as what the text will be about specifically or what the opinion of the writer will be. When the meaning is already understood, the reader can draw conclusion or make judgment concerning, among others things, the content of the text, the stance of the text writer, the way the writer supports his opinion, the writer's claim, the writer's argument, the importance of content to the reader's study, etc. In this process, a good reader can 'question' again through reflective period before eventually making a comment.

Those reading processes involve rational and critical thinking. Having critical reading habits or skills, whose benefits are stated by Cottrell above, can contribute towards students' academic success. Critical reading skills will also indirectly prepare students for their professional career in the future. So, it is true that critical reading skills are a must for students, especially those who are in the level of higher education as they mostly get involved with abstract concepts presented in reading texts that they have to discern. Unfortunately, a lot of students do not really understand what critical reading is (Wallace & Poulson, 2005). That's why the skills should be taught even in early education (Costello, 200).

Apart from students, people can also get benefits of critical thinking mentioned above inasmuch as reading does not solely belong to the students. A homemaker, for instance, who is fond of reading fiction can get the benefits as well. She can judge whether the book is good or not by finding out the consistency of characters presented in it. She can know the moral messages conveyed by the author. She can criticize why the characters in the book behave not

like the real human being, for example. She can say that the story intentionally discredits a certain party and the writer's discredit is actually wrong. She can also say that the description of certain location in the book is not really proper if she happens to know the location exactly. Finishing reading the book, she can conclude that it is worth recommending or not. As a result, reading is not only a static process. Reading activities will be more enjoyable and meaningful (Costello, 2000).

One question arising is whether critical thinking itself can automatically make students good readers with the qualities mentioned by Cottrell above. For example, will students be guaranteed to have an improved ability to respond to the appropriate points in a message without certain characteristics inside themselves? What Cottrell states is actually a skill, and there must be some other factors that can make students possess the ability. There are other characteristics such as motivation or determination that may also be influential. Motivation, together with the student's intellectual development, is an influential factor to possess the skill.

Another point that sounds good but difficult to obtain from Cottrell's argument is 'skills of analysis that you can choose to apply in a variety of situations'. It is good news because problems come to a human being anytime and anywhere, so they need a smart, rational and intelligent solution, otherwise the decision taken is not satisfactory. Nonetheless, the analysis skills are not as easy as turning the hand palm. The skills may be easy to teach, but the result is unpredictable. There are some factors that influence the successful transfer of knowledge or skills such as student, teacher and condition. From a student's point of view, for example, to get the skills, again he needs to have motivation and to practice the skills. When he practices the skills, he gradually internalizes the skills that will become part of his life. Teacher also plays an important role in making the students have skills of analysis. For example, does the teacher present clearly, give enough exercises to students, encourage students' curiosity, or facilitate the learning process well? Those factors, together with other conditions, contribute to the success of skills of analysis.

The reasons mentioned above also prove that mastering critical thinking skills needs some other factors. The one that is very influential is motivation or determination. Motivation must always be existent in any human's endeavour. In short, to achieve the skills mentioned by Cottrell above needs certain characteristics within a human being. After all, the critical thinking skills can be learned and taught, and they are indeed important for everybody as they give various benefits.

Another opinion highlighting the benefits of critical thinking for students is presented by Judge, Jones, and McCreery (2009) who state:

> Some of the most important skills you will need to learn as an education students are the ability to think both critically and objectively about an issue and present a well-constructed argument. Critical and analytical thinking skills such as these will be essential to most aspects of your study, whether you are listening to lectures, contributing to seminars or reading about your subject. (p. 4)

What does Judge et al. mean by 'think both critically and objectively about an issue'? The word critical could mean using cognitive, rational and intelligence, while objective means it is always based on real facts and not influenced by personal beliefs or feelings to avoid personal bias. Why this is important for students is because they will and have to present the argument of an issue. The argument that is built not based on critical and objective thinking will not be convincing at all as it will miss the point.

Judge et al. (2009) also put forward an interesting sentence that states the skills are very important for students to get involved in learning process. Let's take 'reading about student's subject' as stated by Judge et al. (2009) as an example. When a student reads an article written in a well-known journal about a certain topic, he will not directly agree, but there will be some questions circling in his mind such as 'Is the author's opinion true?', 'Should I believe with what the author has said?', 'What supports does the author use to build his argument?', 'Are the supports the author use still arguable?' etc. After that the student will take a reflective moment and comments such as 'Wait, I think what the author has said does not make sense to me', 'I still doubt his opinion because…' etc. will emerge. Then the student can make a decision. These activities absolutely involve the learning processes.

The definition presented by Judge at al. (2009) also put the term 'objective'. Even though objective means free from personal feelings and beliefs, it cannot guarantee that the decision made is fully free from personal bias. Similarly, the decision taken by the student regarding the subject he has read will also involve his personal beliefs a little. People who practice critical thinking must be aware of this tendency. That's why Judge at al. (2009) go on to say that in critical thinking people must also have "the ability to be honest about your own biases and prejudices, flexible in considering alternatives and opinions, and willing to consider and revise views where honest reflection suggests that change is warranted" (p.4).

Students, who get involved in an academic setting, must realize this. They must be open to criticism and different opinion. They must realize that there will always be differences in any aspect of human life, and being different is not always bad. If the students are aware of this and keep this attitude in their whole life, it is expected that they will be a more responsible citizen. That is one of the reasons why critical thinking must be taught at school and included in every school subject.

Knowing the benefits of critical thinking skills, when is the proper time to start teaching the skills? Is it when people start secondary school or when they start higher education? As mentioned, Costello (2000) argues that thinking skills can actually be taught to children, so we can start teaching the skills at primary education. Costello did classroom-based research on teaching thinking skills at early childhood education for his doctoral thesis and reported satisfactory results. He argues against common beliefs that say philosophy is difficult subject to study and the nature of philosophical literature is beyond the understanding of young children. Up to this point, Costello's idea makes sense for two reasons. Firstly, if we can teach mathematics or astronomy to children at primary school, we surely can teach thinking skills to them. Secondly, is 'thinking skills' a completely difficult thing so that it cannot be made simple and adjusted to children's mind? The idea seems doubtful since mathematics, which could be considered difficult, can be taught to children, so can critical thinking.

In countering the argument saying that philosophy is difficult subject to study and the nature of philosophical literature is beyond the understanding of young children, Costello (2000) states:

> In my view, none of the reasons outlined above is sufficient to warrant the exclusion of young children from the discussion of philosophical problem. Indeed, I would argue that exposure to the skills of critical thinking and reasoning at an early age is essential if children are to cultivate those reflective habits which are crucial to their future lives as citizens in a democracy. To begin this process only at a university or other higher education institution is to arrest children's intellectual development and to imply that 'education for citizenship' is simply an exercise in indoctrination. (p. 47)

Interesting points of Costello's argument are reflective habits are crucial to children's future life as citizens in a democracy, and starting teaching thinking skills at higher institution

will arrest children's intellectual development. The phrase 'reflective habits' is very interesting. As mentioned above, reflection - for a student at higher institution - is needed to see his stance or view on the academic article he was reading, for example. This is the moment when he is in deeply careful thinking before deciding or making action. In every day's life, when this becomes the habit, he can perform well in a democratic society due to his objective position. A person who has no reflective habit might be an intolerant one and easy to blame others.

When thinking skills start to be introduced to children, this could be a habit until they learn at higher institution. Eventually, they are expected to be a scholar who can accept differences to find the truth. They could be a person who respects other people in terms of opinion, social status and belief. Even they could be a person who keeps learning to improve the quality of themselves as a human being. Finally, "omitting to offer children explicit teaching which is aimed at fostering their thinking and valuing processes, may have serious implications for their academic achievement" (Costello, 2000, p. 47). An idea of introducing critical thinking skills in education starting from early education as proposed by Costello is a good idea.

Apart from the benefits of critical thinking for students, professionals can benefit from the thinking skills as well. Cottrell (2004) argues that "skills in critical thinking bring precision to the way you think and work. You will find that practice in critical thinking helps you to be more accurate and specific in noting what is relevant and what is not" (p. 4). Cottrell's argument seems astonishing, and there is a possibility that it happens in the real world. Working world is imbued with decision making that needs critical thinking skills.

There are some reasons why critical thinking can make someone more accurate and specific. First of all, it starts when someone is still a student. Since he is engaged in critical thinking processes as having been mentioned by Cottrell such as improving ability to identify the key points in a text or other message rather than becoming distracted by less important material and improving ability to respond to the appropriate points in a message, he will be accustomed to accuracy and specification. There is the process of habit formation. Then the habit gradually will be part of his character when he lands a job.

Nowadays, almost all fields need critical thinking skills. For example, professionals in the field of social work, according to Brown and Rutter (2007), also need critical thinking skills. Again, this is related to the decision making. It is clear that the processes in critical thinking such as observation, question, evaluation and reflection become the foundation of

making a decision that is crucial for professionals. With respect to critical thinking skills for professionals in social work, Brown and Rutter (2007) state that "social work as a profession has always demanded critical abilities and qualities from its practitioners because decisions have to be made 'on the spot' and under pressure" (p. xii).

The fact that professionals in the field of social work often have to take decisions quickly becomes the reason why they need critical thinking skills (Brown & Rutter, 2007). One possible alternative to make better decision is through critical thinking in which information coming must be observed and questioned critically and intellectually. Then it is evaluated before a person performs a reflective thought. Finally, intelligent decision is made. Brown and Rutter (2007) go on to say that "…developing critical abilities within the social work arena can also enhance learning and development and there is potential to progress your own style of critical professional thinking" (p. xi).

What Brown and Rutter (2007) say that critical abilities can enhance learning and development also applies equally to other professional fields. This is because learning and development is an inseparable part of human's lives. To make the most of learning and development, a human must be able to think critically. Thinking is actually a human's responsibility; unavoidably, a human has to think. Stopping thinking could mean the end of life because learning and development will also stop.

Everybody is different indeed, and even though a group of people, for example, is taught how to think critically by the same teacher in the same classroom, they will surely develop their own creativity. This creativity is celebrated by Forshaw (2012) commenting on the role of critical thinking in the field of psychology. Forshaw (2012) states that "good critical thinking can be creative: it's all about putting ideas together in new ways and making us think of things we didn't think before" (p. 3).

We can see that there are various benefits if critical thinking is introduced to students. They can be successful in the academic journey, and critical thinking can equip them to be individuals who can compete in future lives when becoming professionals. Since critical thinking bring some benefits to people, its inclusion in school subjects of all levels of education is worth trying.

Concerns for Lack of Critical Thinking in Indonesian Education

Even though many authors have believed and shown that critical thinking can bring benefits to students, the teaching of critical thinking does not seem to be widely implemented in

Indonesian education. Indonesian students therefore are likely to lack critical thinking. Some Indonesian academics (e.g. Alwasilah, 2002; Nugroho, 2008; Syofyan, 2012) have voiced their concerns regarding this. Alwasilah (2002) states:

> Realizing that our students have been left behind compared to their counterparts in other Asian countries, we need to update ways of teaching both national and foreign languages at all level of education, from elementary to university. Language teaching at present should be aimed at meeting global challenges. In the final analysis, though, basic to success in global competition is the mastery of critical thinking.

It is almost impossible for young Indonesians to be successful in the competition of global job market without critical thinking. Alwasilah's opinion is reasonable since people who hold decision-making position in a company must always think to find ways of becoming a market leader. People with poor critical thinking will not win. Lack of critical thinking in education might be what is happening in Indonesia. That causes Indonesia can only send domestic, not professional, employees whose number reach more than 10 million people (Krismantari, 2012). Conversely, rote learning - not critical thinking - is still widely adopted in Indonesian education. Nugroho (2008) points out:

> For decades education in Indonesia has been dominated by teacher-centred instruction and rote learning. I remember very well what my teacher would do in her history class while I was in junior high school. She would come into the classroom, sit down and begin to lecture. All students would sit, listen to the lecture and take notes. The teacher would also ask her students to memorize all names of the ministers who had assumed office in the Cabinet. Another teacher required students to be able to name the cities where the National Sports Week had been held, including the dates and years they took place. These examples are perhaps commonplace in most Indonesian classrooms even today.

That is why Syofyan (2012) comments that "…we must move away from 'rote learning' (a memorization technique based on repetition) so that our youth do not form rigid mind-sets."

The condition like this is found in all formal schools all over Indonesia (Balfas, 2008). As a result, most Indonesian students are not accustomed to giving comment on the pieces of writing they have read, stating opinion to a problem, or analysing reading passages critically. They are mostly not creative and still left behind by their peers even in Asian countries

(Megawangi, 2007; Yusuf, 2006). Up to now, this seems to still exist in Indonesian education.

Apart from having low reading skills, Indonesian students' writing skills are also not very satisfactory. Imran (as cited by Syaifudin & Utami, 2011) reports that Indonesian students have very low writing skills. Syaifudin and Utami (2011) go on to say that:

> *Hasil penelitian itu menyebutkan bahwa kemampuan menulis siswa Indonesia paling rendah di Asia. Padahal pembelajaran menulis diberikan mulai pendidikan dasar hingga pendidikan tinggi. Hasil ini menunjukkan bahwa berpikir kritis siswa masih rendah pula. Ini disebabkan adanya hubungan berbanding lurus antara menulis (terutama menulis argumentasi) dengan berpikir kritis siswa. (p. 66)*
>
> The result of the research shows that writing ability of Indonesian students are the lowest in Asia, whereas writing lessons are taught starting from elementary school to higher education. The result shows that students' critical thinking is also low. This is because there is direct relation between writing (especially argumentative writing) and students' critical thinking skills. (p. 66)

Indonesian students cannot be blamed for their lack of critical thinking. This may happen because teachers do not teach them critical thinking. Why teachers do not teach them critical thinking may be because they were not taught how to be critical during their education. As a result, they are less creative and innovative in teaching. They tend to rely on textbook, not challenging students' curiosity. The research conducted by Direktorat Dikmenum (The Directorate of General Secondary Education) of The Indonesian Ministry of Education and Culture in 1996-1997 shows that the teaching process at secondary schools tends to be textbook oriented that is not related to students' daily lives (Balfas, 2008). Though the research was conducted almost 18 years ago, the present condition does not seem really different.

That critical thinking is not popular to most school teachers in Indonesia is also supported by another study. A study by Ajisuksmo and Vermunt (as cited in Soeherman, 2010) reported that educational settings in the country are dominated by teacher's lectures and students' memorization to pass the examination. Even in higher education Soeherman (2010) contends that "there is no specific course called 'critical thinking,' yet the content of some courses, such as research methodology classes, may indirectly develop critical thinking

ability. Nevertheless, teaching methodologies applied in these classes are not intentionally structured to foster students' critical thinking skills" (p. 5).

As mentioned, rote learning and memorization that are widely adopted in teaching and learning approaches in Indonesia are actually not bad. In learning a foreign language, for instance, memorization is one of good strategies to remember words, phrases, collocations, or tenses. Yet, those vocabularies will not be internalized if they are not used in writing and speaking. Students should not only be asked to parrot words or memorize facts from reading passages but also be encouraged to discuss the reading passages and give comments both in spoken and written language. Students should be given an opportunity to think and taught how to think critically to respond to something that comes into their mind. Memorization makes people tend to accept something without criticizing it, and it is not really supportive in learning. Therefore, critical thinking should be added in the teaching process to counter weaknesses memorization learning strategy has. Related to this, Richmond (2007) states:

> The educational methods commonly used in developing countries, particularly rote learning by students expected to be passive recipients of knowledge, are mostly ineffective at training professionals to think critically and creatively about the development needs of their nations. Whether mathematical formulae or facts are memorised, parrot-learned material lacks practical applications without an ability to place it in the context of local environments, where social and economic systems and priorities, finances, and managerial and political practices may be anything other than that outlined in the textbook. (p.1)

The doubt about most school teachers, even university lecturers, in Indonesia do not apply critical thinking in their teaching is supported by Hatmanto, the head of English Department at Muhammadiyah University of Yogyakarta, Indonesia. During opening remarks on the seminar taking theme "Constructivism Theory in Teaching Method for Teachers and Lecturers", Hatmanto (2011) states that:

> *Selama ini metode pengajaran yang diberikan seorang dosen maupun guru masih menggunakan pendekatan konvensional dengan metode pengajaran repetisi atau pengulangan. Metode ini alhasil menyebabkan pendidikan dan penguasaan materi yang diajarkan kurang maksimal dan siswa juga kurang bisa berfikir kritis.*

> All this time, teachers and lecturers still teach conventionally by using repetitive method. This method makes education and materials mastery less maximal and makes students lack critical thinking.

The studies, along with the opinion of some educators, having been mentioned above are concerned with no critical thinking teaching in Indonesian education and lack of critical thinking understanding among Indonesian school teachers. Since critical thinking bring many benefits, its serious implementation in Indonesian education needs considering.

Critical Thinking and the Teaching of English as a Foreign Language

With critical thinking gaining its popularity in education, the field of teaching English as a foreign language (TEFL) has also started to adopt it. Though there is criticism stating that critical thinking may not be successful in TEFL as it is a Western concept and could be problematic when applied in non-Western countries, many authors (e.g. Beaumont, 2010; Benesch, 1999; Davidson, 1998; Hawkins, 1998) challenge this criticism, and some studies (e.g. Barjesteh, Alipour, & Vaseghi, 2013; Daud & Husin, 2004; Hashemi & Ghanizadeh, 2012; Huang, 2012) have proved that infusing critical thinking into TEFL is successful.

Huang (2012), for example, did a qualitative study by exploring "students' writing practices when a critical literacy perspective is incorporated and considers the implication for the EFL curriculum" (p. 284). The 20 participants were students at a university in Taiwan and had taken general English course for one year. The data being generated in the study were students' research papers, reflection papers, writer's autobiographies and researcher/teacher journal and notes. In this study the researcher acted as the teacher. In analysing the data, Huang (2012) read the data several times. The data of each student were organised into a file, and they were coded "for the ways in which they positioned themselves in relation to the themes and the research focus they chose, how they made sense of the knowledge they gained from the literature, and how they understood the social significance and implications of the research topics and findings" (p. 286). Huang compared the codes, looked for pattern of critical/uncritical engagement in the writing and generated broad themes explaining students' critical disposition.

In this study, Huang (2012) assigned students to write a research paper which was divided into four assignments: background and research question, literature review, argument & critique and conclusion. In every stage, students were asked to be critical. For example, in

the first assignment students were asked to explain the choice of theme and reasons of research focus, while in argument and critique assignment, students were asked to argue their point of view based on the findings from literature review. Several themes for the research paper writing such as advertisement, gender, global warming, child labour, global economy, global warming and popular culture were proposed, and for the first three weeks Huang dealt with students' understanding of critical research and choice of theme/topic. The articles about the themes were discussed in the classroom. The students were also asked to present after each assignment, and individual consultation was facilitated.

The data analysis generated three themes informing the students' critical disposition: writing as the intersection of self and world, writing for purposes of knowledge transformation and knowledge creation, and the writer as socially relevant and locally/globally involved. With regard to the first theme, Huang (2012) writes:

> Through the research-based writing, these students examined issues that speak to marginalised groups in society (e.g. child labour) as well as those that concern social relations (e.g. advertisement) and human rights (e.g. same sex marriages). They also employed research writing as a way to explore their own roles in relation to a worldwide problem (e.g. global warming). In other words, when an explicit connection is made between writing and social issues, students were able to construct themselves as writers who use English literacy to assert their membership and participation in the global village and thus cross the boundaries of the classroom into the broader world. (p. 291-292).

In relation to the second theme, Huang (2012) informs that the students' writing showed "their ability to reconceptualise their own understanding and societal assumptions of an issue" (p. 292). For example, one student who chose the theme of gender was able to see the debate on the same sex marriage in which those against the marriage always used degradation of familial values, HIV, the interruption of constitutional marriage and the neglect of children rights as the argument. The student, as reported by Huang (2012), argued that this was because people were usually concerned about maintaining their status quo.

The study conducted by Huang (2012) seems innovative in which she incorporated critical literacy pedagogy to find out its impact on the students' writing a research paper. Two factors that may contribute to the students' critical disposition are the discussion processes of

themes (advertisement, child labour, gender, etc.) and the progressive stages through individual consultation in making students understand how to write a critical research paper.

Huang (2012) reports that 16 out of 20 students produced research papers which reflected a critical orientation. Even though the study did not inform the criteria for differentiating between critical and uncritical writing, the quotes of students' works provided reveal that critical literacy pedagogy is able to promote students' critical thinking. Therefore, Huang's (2012) conclusion stating that "the study has demonstrated the potential of critical literacy for EFL (English as a Foreign Language) curriculum" (p. 296) can be accepted, and infusing critical thinking into EFL should be possible.

CRITICAL THINKING AND ENGLISH COURSEBOOKS

Critical Thinking Framework

As mentioned, there is no agreed definition of critical thinking. Each critical thinking book proposes different definition and conception of critical thinking. This also happens to critical thinking frameworks or taxonomies. In fact, many authors have proposed critical thinking frameworks that can be used in education; however, their frameworks seem incomplete to explore critical thinking skills in school subjects, including EFL. Besides, some critical thinking taxonomies lack explicit examples when applied in education. Take Bloom's taxonomy as an example. Bloom's taxonomy is widely believed to be able to promote students' critical thinking, especially higher stages such as analysis and evaluation. However, those stages lack explicitness, and though some authors have added verbs to the stages, some verbs overlap. Besides this, there are no examples of using the verbs in each stage.

Ilyas' (2015) framework of critical thinking can be an alternative. The framework was constructed by synthesising, examining and evaluating 20 critical thinking taxonomies, programmes, strategies and test. The critical thinking strategies examined and evaluated were from six empirical studies which infused critical thinking into EFL (Dantas-Whitney, 2002; Daud & Husin, 2004; Davidson & Dunham, 1997; Park, 2011; Shahini & Riazi, 2011; Yang & Gamble, 2013). Ilyas' framework of critical thinking therefore can be used in exploring students' critical thinking in the teaching of English as a foreign language and possibly in other school subjects.

Table 1: Ilyas' framework of critical thinking

Clarification
Assumptions
Reasons and Evidence
Viewpoints or Perspectives
Implication, Consequences and Alternatives
Question
Predictions
Agreement and Disagreement
Summary and Conclusion

Infusing Critical Thinking into Reading Texts

Critical reading, which is an integral concept of critical thinking, can be implemented in the EFL classroom. Applying critical thinking to reading texts not only promotes reading comprehension skills but also encourages students' independence in analysing and criticising the texts, thus avoiding them to become the victims of text propaganda.

Infusing Ilyas' framework of critical thinking into reading texts in English coursebooks can be done by generating additional questions asking clarification, assumptions, reasons & evidence, viewpoints or perspectives, implication, consequences & alternatives, question, predictions, agreement & disagreement, and summary & conclusion. 'Additional questions' here means questions that complement original questions in the coursebooks, which may not promote students' critical thinking. In practice, original questions provided by the textbook writer(s) can be used as a scaffold before moving to critical thinking activities.

Questions asking clarification can be the ones asking students to clarify words, phrases, or sentences. Other questions can ask students to clarify the text writer's intention or clarify the message the writer wants to convey. Questions about assumption can ask students to find out what the writer or a paragraph assumes. Regarding reasons and evidence, students can be asked to find out reasons or evidence the writer provides to support his claim, for example. This can be followed by questions asking students to provide alternatives instead of the ones proposed by the writer.

Students can also be asked to predict what will happen if, for example, the solution proposed by the text writer is not implemented or fails. Again, in this stage students can be asked to propose their own alternatives or to give their own perspectives. This can encourage them to express their opinion, at the same time applying the questions about viewpoints or perspectives.

Regarding agreement and disagreement, students can be asked to support why they agree or disagree with the text writer, for example. If the writer does not summarise his article, students can be asked to summarise or conclude the article and comment on it. Finally, students can be asked to present their evaluation of the article.

The infusion of Ilyas' critical thinking framework into the reading text can be found in the appendix. The text was taken from the English textbook's 2006 curriculum *Developing English Competencies: Natural and Social Study Programme* grade 11 of senior secondary school; the reading text titled 'The Importance of Rainforest' on page 65 was chosen since the topic seem suitable for promoting critical thinking. The questions provided in the textbook do not seem to optimise students' critical thinking skills. For example, one of the questions in the True/False section asks 'Rainforests are unimportant to our life on Earth (sic).' Reading the statement, it is easy to say that it is false without reading the text because rainforest must be important for us. The examples of critical thinking questions in the appendix are not rigid; teachers can modify and vary the questions based on the critical thinking framework.

CONCLUSIONS

Critical thinking has been fashionable in education. It may answer the problems approaches in education such as rote learning cannot solve. Furthermore, critical thinking is a skill needed in this globally changing world in which competitions grow ever more impressive and a stream of information cannot be resisted. People lack of critical thinking could be the victims of propaganda and may be easily manipulated.

Though critical thinking has been included as one of educational objectives in Indonesia, it is not clear what kind of critical thinking needed in education in this country. Many Indonesian schoolteachers do not seem to know how to promote students' critical thinking skills by optimising coursebooks or textbooks provided freely by the Ministry of National Education. This might be due to no clear directives by the authority in this regard, or

this may be because the critical thinking tradition is not strong in Indonesian education. Possibly, this could be both.

Several critical thinking frameworks/taxonomies attempt to help teachers encourage students' critical thinking skills. Few of them lack explicit examples for teachers like Bloom's taxonomy, while the majority of them seem to overlap. Ilyas' critical thinking framework, which was the result of synthesising, examining and evaluating twenty critical thinking taxonomies, strategies, programmes and tests, has come up to fill the gap. The framework can be used in the field of ELT as it examined and evaluated empirical studies infusing critical thinking into this field.

The critical thinking questions adopted from Ilyas' critical thinking framework provided in this article are the examples how teachers can promote critical thinking in the classroom. In practice, they can vary the questions adjusted to the students' level of education. The questions may be able to promote students' critical thinking skills; however, further investigation needs to be conducted.

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APPENDIX

The Importance of Rainforests

Rainforests are one of the most complicated environments on Earth. They are recognised worldwide as containing the richest source of plants and animals and are believed to contain nearly three-quarters of all the varieties of life on Earth. This is remarkable because rainforests cover only about six per cent of the Earth's land surface.

Rainforest are the oldest major ecosystem, having survived climate changes for more than one million years. They provide habitats for more species of plants, animals, insects and birds than any other environment found on our planet. Scientists estimate that between 60 and 90 per cent of all species of life are to be found in rain forests. Unfortunately, the widespread destruction of many of the world's rainforests has caused a significant decline in the number of plant and animal species on Earth.

Rainforests influence both our local and global climates. For example, between 50 and 80 per cent of the moisture in the air above rainforests comes from the rainforest's trees. If large areas of these lush rainforests are cleared, the average rainfall in the area will drop.

Eventually, the area's climate will get hotter and drier. This process could convert rainforests into a sparse grassland or desert.

Rainforests are also able to absorb over 90 per cent of the rainfall in their leaves and mosses. By doing this, they are able to slow down water run-off by gradually releasing the water over time into streams and rivers. This helps to control soil erosion and flooding.

Rainforests are vital to the Earth in helping to recycle carbon and oxygen. Carbon dioxide (CO2) is the gas put into the air globally by humans, mainly by the burning of fossil fuels (for example in cars and factories). Rainforests are able to remove carbon dioxide from the air and return oxygen in its place. This is why our global rainforests are often called the Earth's 'lungs'.

Rainforests are major producers of the Earth's oxygen. In fact, scientists believe that nearly 50 per cent of the Earth's oxygen is produced by rainforest in the Amazon region alone. Nearly 40 per cent of the world's carbon is contained in the trees of the rainforests. As rainforests are cut down and burned, carbon dioxide is released into the Earth's atmosphere. Eventually, as this gas builds up the atmosphere, leading to what scientists call the enhanced greenhouse effect.

To sum up, the role of the rainforest is essential for human life. It creates equilibrium in our environment and its resources are significant for human beings' survival.

Some examples of questions promoting students critical thinking skills based on Ilyas' critical thinking framework:

1. Questions about clarification: *What does the writer mean by 'equilibrium' in the last paragraph? What does 'Rainforest are the oldest major ecosystem' mean? What does 'a significant decline' on paragraph two mean? What does the word 'remarkable' on paragraph one mean?*

2. Questions about assumption: *What does the writer assume that 'Rainforests are one of the most complicated environments on Earth'? What does the writer assume by saying that rainforest is called the Earth's lung? What do you assume based on the information of paragraph two?*

3. Questions about reason and evidence: *What evidence did the writer give to support his/her opinion that 'Rainforests influence both our local and global climates' on paragraph three? Is the evidence provided strong enough to support his/her opinion? What evidence do you think the writer still need to include in the text? Do you believe in what the writer has written in the text? Why?*

4. Questions about viewpoints/perspectives: *What is your opinion about rainforest? Why is it important to keep the existence of rainforests? What are some ways to keep rainforests from declining? What information would you add if you were the text writer? Why? In general, what do you think of this text?*

5. Questions about implication, consequences and alternatives: *What are the consequences if rainforests keep declining? What does the writer imply from paragraph 5? What are the impacts of greenhouse effects? What does the text imply?*

6. Questions about question: *What questions are you going to ask to the text writer about rainforest? What questions in number 3 above ask you to do?*

7. Questions about prediction: *Can you predict what will happen if people do not preserve rainforest seriously? What will happen to rainforest in Indonesia 20 years from now?*

8. Questions about agreement/disagreement: *Do you agree/disagree with the writer? Why? Do you agree with the statement saying that rainforests influence both our local and global climates? Why? Is there information from the text that you disagree? Why?*

9. Questions about summary and conclusion: *Does the text provide a summary? Why/Why not? Can you summary the text? What do you conclude from the text? Can you make a conclusion in one sentence stating the importance of rainforest?*

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Retaining Literature in the Indonesian ELT Curriculum

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Abstract

This article presents serious independent arguments why literature needs to be retained in the Indonesian ELT (English Language Teaching) curriculum. In general, ELT curriculum nowadays seems to neglect the importance of literature since the introduction of the communicative approach. Three aspects are presented in connection with why the notion may need immediate application: (1) literature brings many advantages to Indonesian ELT learners; (2) literature can be used to teach critical thinking skills; and (3) critical thinking can be used to promote tolerance. This article is developed based on mainly the ideas of literature teaching proposed by Collie and Slater (1987), Lazar (1993), and Ghosn (2002). Hence, critical thinking and tolerance are values not getting serious attention in educational processes in this country even though these values have been included in the National educational objectives for Indonesia.

Keywords: Literature, critical thinking, ELT, tolerance.

1. INTRODUCTION

One of the widely neglected issues in ELT (the term ELT herein refers to EFL, ESL, TEFL and TESOL) is literature. This may be due to the popularity of communicative approaches. Literature, however, is believed to be beneficial for ELT learners, and ELT students can benefit from the role of literature in promoting, among other things, language acquisition and language proficiency. The potential benefits of introducing literature in ELT classrooms seem to have been forgotten in recent ELT curriculum. The examination of ELT textbooks from the 2006 and 2013 curriculum used for teaching ESL to Indonesian senior secondary school students is in favour of this proposition; only books aimed for students majoring in language programmes contained literary works.

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This article therefore attempts to present various benefits of including literature in the context of teaching ELT in Indonesia. Apart from such benefits as exposing learners to authentic materials and introducing them to different cultures, retaining literature in the Indonesian ELT curriculum can also be used to promote critical thinking skills amongst learners. It is also argued that the teaching of critical thinking is needed to make learners aware of tolerance, which is a value that is very important for a pluralist society such as Indonesia, but it seems to be ignored in education now.

2. LITERATURE IN ELT

2.1 The Benefits of Teaching Literature in the ELT Classroom

A considerable amount of literature has been published on the importance of teaching literature in both first and second/foreign language settings (e.g. Akyel & Yalcin, 1990; Brumfit, 1981; Campbell, 1987; Elliot, 1990; Shelton-Strong, 2012; Talib, 1992). Regarding promoting a student-centred approach in ELT methodology, using literature may facilitate this method. Students, for instance, can be assigned to work in groups, discussing then presenting the motivation of the protagonist in a fictional work or how the story could end differently if the protagonist did not succeed in pursuing his/her goal. Such activity is supported by Van (2009) who argues that "the study of literature is amenable to student-centred activities that offer opportunities for collaborative group work such as reader-theatre, drama, and other projects where English is the common medium of authentic communication" (p. 8).

The promotion of a student-centred approach is not the only advantage of using literature in ELT. Due to the richness of characters in literature which represent, among others, the writer's imagination, portraits of social life, and the suffering of humans living their lives, the use of literature can have many benefits for learners of English. There are at least four serious noticeable advantages why literature needs to be retained in Indonesian ELT. Collie and Slater (1987) and Lazar (1993) argue that literature can help learners understand another culture (cultural enrichment) and provide stimulus for language acquisition (language enrichment). Besides this, as most literary works are not written for special use in the classroom, literature can expose learners to authentic materials. Finally, another advantage of introducing literature in the ELT class is encouraging learners to talk about their opinions on and feelings about the characters in the literary works they study.

A fictional work is a representation of a culture as it has a setting. Values considered normal or even noble in a particular setting may be different from those in a setting where the reader resides, hence people's perception of values need not be the same. Sexual orientation, for example, is still a big issue in most Eastern and predominantly Muslim countries, like Indonesia. Similarly, female circumcision - often referred to as genital mutilation - is considered to be against humanity in Western countries while it is a common practice in a country like Nigeria and even in Indonesia until recently. Social interaction among community members is also different from culture to culture. These aspects, which to a large degree are represented in works of

fiction, may enrich the cultural exposure of students. Such exposure to different cultures can broaden the horizons of students and importantly make them appreciate different values from different cultures.

Regarding language enrichment, using literature in ELT is believed to be able to enrich language acquisition by students. This has been proved by several authors (e.g. Janopoulos, 1986; Lao & Krashen, 2000; Mason & Krashen, 1997). A study by Lao and Krashen (2000), for example, showed that the experimental group, first year students majoring in translation in a university in Hong Kong, who were assigned to read six fiction books in one semester gained more significantly in vocabulary growth and reading rate than the comparison group, who were not assigned to read novels. They also reported that "experimental subjects also indicated that they were more interested in pleasure reading as a means of improving their English than they were before taking the class, and felt that the literature class would help them in future study" (pp. 267-268).

What differed significantly between the experimental and the comparison group from the study by Lao and Krashen (2000) may be due to the experimental group's exposure to 'interesting' authentic materials, supporting the third advantage of using literature in ELT. Reading novels could be more interesting than reading non-fiction, so this increases students' motivation to improve their English. That students' motivation increases when exposed to fiction as authentic materials is also proved by Peacock (1997) who conducted a study at a South Korean university EFL institute. Among authentic materials he chose were poems and American pop songs, which can be categorised as literature. He reports that using authentic materials significantly increased students' motivation. The results might be different if the authentic materials used in the studies above were not as interesting as novels, poems, or pop songs.

One question that needs to be asked, however, is whether literature is suitable for low level EFL learners. An issue arising in the light of this proposition is: *Is the language used in literary texts easy to understand, especially for low levels?* This is because literary works can contain unusual vocabulary. 'Unusual' in this context means that the words or language expressions in the literature are seldom found in other genres of writing such as in newspaper articles or college textbooks for international students. These unusual expressions are sometimes deliberately used by the authors to create metaphorical effects. Besides this, material that is difficult may lower the motivation of the learners so that learning objectives are not achieved. Novels, short stories and poems can contain language that is complex in structure, also. These are all factors that could possibly inhibit the introduction of literature to ELT beginners.

Responding to the abovementioned issues, Lazar (1994) argues that "despite their very limited proficiency in the language, students need the challenge and stimulation of addressing themes and topics which have adult appeal, and which encourage them to draw on their personal opinions and experiences" (p. 116). The idea of encouraging ELT learners to draw on their personal opinions and experiences seems interesting, and it is in agreement with the fourth advantage of using literature in ELT and with the notion of promoting critical thinking amongst learners through literature. This is supported by Ghosn (2002) who argues that teaching literature in ELT contributes to developing critical thinking amongst leaners and to developing character aspects that are favourable for academic achievement and for success in life. She states:

> …Third, literature can promote academic literacy and thinking skills, and prepare children for the English-medium instruction. Fourth, literature can function as a change-agent: good literature deals with some aspects of the human condition, and can thus contribute to the emotional development of the child, and foster positive interpersonal and intercultural attitudes. (Ghosn, 2002, p. 173)

However, even though literature can be introduced to lower levels, the argument about the gap between their language proficiency and difficult language expressions, structure and vocabulary in literature needs to be taken into account. Therefore, the reading materials chosen for study need to be selected to match the English proficiency of the learners. Hence teachers may need to introduce graded readers. Hill (2008) writes that "graded readers are books written for learners of English using limited lexis and syntax, the former determined by frequency and usefulness and the latter by simplicity" (p. 185).

Apart from avoiding the possibly inhibiting factors mentioned above, adjusting the literature to the language proficiency will help learners have a smooth transition, hence preventing frustration and facilitating a gradual process of language acquisition and critical thinking. At the same time, the students can still enjoy the beauty of the story. When exploited well in the ELT class, this may bring many similar benefits as previously mentioned. Besides this, studies on promoting critical thinking through critical reading by using literary works - as can be seen in the sub-section that follows - have proved that gradual progress needs to be facilitated. Graded readers certainly may be the answer to this issue.

Assigning ELT students to start to read literary works and engage in thought-provoking activities based on those works may be one of the answers as to how Indonesian ELT can be improved. Literature was once the focus of foreign language teaching in Indonesia during the Dutch colonial era. World literature was taught to MULO (Meer Uitgebreid Lager Onderwijs) students in language classes. MULO was comparable to junior secondary school at present. The teachers asked their students to read literary works and give responses (Agung, 1993). Agung, who was educated at MULO during the Dutch colonial era, wrote in his biography:

> *Di kelas empat pelajaran bahasa Belanda, Inggris, Perancis dan Jerman tidak lagi menyangkut soal gramatika atau penterjemahan dari bahasa Belanda ke bahasa asing lainnya atau sebaliknya. Kurikulum dalam bidang ini mencakup pelajaran mengenai perkembangan sastra (literature) dalam keempat bahasa tersebut yang sangat menarik bagi saya. Dengan cara inilah saya mengenal sejarah sastra Eropa Barat (Belanda, Jerman, Perancis) dan mengetahui sekedarnya wakil masing-masing periode perkembangan sastra itu dengan karya-karya mereka, misalnya saya mengenal nama penyair Belanda Vondel dari abad ke-16 sampai nama Douwes Dekker (Multatuli) dan Couperus dan lain-lain.* [*Translation:* In grade four, the language courses such as Dutch, English, French and German were no longer about grammar or translation from Dutch to other foreign languages or vice versa. The curriculum, which covered the development of literature in those four languages, was very interesting for me. This taught me about the history of

> literature in Western Europe (The Netherlands, Germany, and France) and I learnt about representatives of each development period of literature through their works. For example, I learnt from the 16th century Dutch poet Vondel up until Douwes Dekker (Multatuli) and Couperus and others. (Agung, 1993, p. 56)]

Exposure to world literature was also experienced by Lien, the wife of a former Indonesian vice president, who attended Dutch education at VHO (Voorbereidend Hoger Onderwijs). This was a two-year school after junior secondary school. In her biography, written by Janarto (2000), it noted that:

> *Untuk pelajaran bahasa Inggris, misalnya, Lien tidak hanya diajar oleh Mrs. Bowdies mendalami grammar atau structure semata, tapi juga diminta mengapresiasi buku-buku sastra klasik dunia. Untuk itu, diantaranya Lien diharuskan membaca karya-karya pujangga William Shakespeare dan berbagai sastrawan besar lain. Sekaligus ia diminta membuat semacam book report, yakni risalah yang berisi ringkasan berikut ihwal karya sastra klasik tertentu. Lakon Hamlet karya Shakespeare, misalnya, telah ia bahas dan kupas habis. Masih pula ia diminta untuk menceritakan kembali isi lakon terkenal itu di depan kelas. Tak mengherankan, para murid VHO dikenal jago berbahasa Inggris dan Belanda.* [*Translation:* For English lessons, for example, Mrs Bowdies not only taught Lien grammar or structure but also classical literature from the world. Therefore, she had to read the works of William Shakespeare and other great writers. She was also asked to make book reports, to summarize what she had read. She, for instance, deeply analysed Shakespeare's Hamlet. As well as this, she was asked to retell that famous play in front of the class. It is no wonder that VHO's students had a very good command of English and Dutch. (Janarto, 2000, p. 18)]

Compared to Indonesian junior high school students nowadays, I doubt that they are being asked to read world literature and discuss its contents. They may not even be asked to read recent popular literature like Harry Potter. That is why many people claim that junior high school students during the Dutch colonial era already had a good command of the English language compared to recent junior, even senior secondary school students. Also, the EFL curriculum in the teacher training and pedagogy courses does not seem to optimise the potential role of literature to improve the teaching programs for English. That is one reason why when they become secondary school teachers, they do not optimise the potential for using literary works for teaching related activities nor promote the reading of literary works in their classrooms, they just do not know about it.

2.2 Using Literature to Promote ELT Students' Critical Thinking Skills

Critical thinking is unique since almost all academics, especially in the Western countries, know what it is and know when their students' works are not critical, but there is no agreement on its definition. A study by Moore (2011) looked at the elusive concept of critical thinking. Among 17 academics from different fields of study in an Australian

university in his research, no one proposed the same or a similar definition of critical thinking. Books on critical thinking also propose different definitions. Two scholars who are actively involved in thinking about critical thinking are Paul and Elder (2006). Their conception of critical thinking is interesting since it touches the issues of egocentrism and socio-centrism, thus relating critical thinking beyond the school/university subjects. Paul and Elder (2006) wrote:

> Critical thinking is defined as self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It entails effective communication and problem-solving abilities, as well as a commitment to overcome one's native egocentrism and socio-centrism. (Paul & Elder, 2006, p. xxiii)

Their definition argues that critical thinking enables one to see something from a wider perspective and avoid seeing something only from one's own perspective. This seems important in academic and social life because decision making is not solely based on personal assumptions. Their definition also suggests that one can correct one's own thinking, hence arguing that critical thinkers are not rigid in their own beliefs as old beliefs may be misleading.

As mentioned above, literature has been believed to be beneficial in ELT since one of its benefits is purported to be the development of critical thinking. Promoting critical thinking needs to be learnt in stages as it seems impossible for learners to be critical without being taught how to do so, and some studies have proved this proposition (Commeyras, 1990; McDonald, 2004; Urlaub, 2012). These empirical studies showed that promoting students' critical thinking skills could be successful if it was conducted in stages. One of the most interesting aspects of the studies is that they used literary works to promote critical thinking. Such studies may fill in gaps in the literature because, so far, very few studies have investigated the role of literary works in promoting critical thinking skills amongst ELT learners. These studies are therefore selected and reviewed in this article.

Urlaub (2012), for example, conducted experimental research in an L2 (second language) setting where American students were learning German. Her study attempted to find out whether training in reading comprehension strategy, generating questions, benefited ESL (English as a Second Language) students to improve their critical reading/thinking. As the source of discussion, she used German short stories titled Das Brot and Nachts Schlafen die Ratten doch by Wolfgang Borchert. The study, which was conducted at the Language Centre at Stanford University, focused on the reading comprehension strategy for acquisition of self-generating questions for an experimental group (n=14) and on the strategy similar to teaching traditional L2 literature for the control group (n=7). Pre-test, treatment and post-test measured the participants' ability to give a short critical response essay. She created a rating rubric ranging from 0 to 3 in which number 3 showed that the learners were capable of critical analysis. Her results showed that the experimental group's training was more effective than the control group's traditional training. In doing her study, Urlaub showed the students in the experimental group how to use a scaffold.

The study by Urlaub (2012) used a scaffold with 4 stages: (i) teaching learners to evaluate components in the literary text such as characters, settings, actions and objects, (ii) teaching the learners strategy to self-generate questions, (iii) giving examples of how the strategy was used, and (iv) teaching the learners the strategy to present critical responses to the text. Even though the study involved only a small number of participants, it showed that facilitating students' critical thinking skills needed stages. Thus it can be assumed that the success in encouraging critical thinking by the students was partly due to the scaffold, apart from using literary works in the study.

Using literature to promote critical thinking skills amongst students also seems to work well for young learners. McDonald (2004) conducted a case study with 10-11 year-old primary school students in Sydney, Australia. The students came from different countries, many of whose native language was not English, and the study was balanced in terms of gender. The study used a novel titled *I am Susannah* by the award-winning Australian novelist, Libby Gleeson. In doing the study, McDonald introduced critical pedagogy approaches such as appraising characterization from a 'different' perspective, contrasting gender characterization and presenting an alternative (feminist) discourse. However, before the students were exposed with critical thinking activities, they were exposed to a non-critical pedagogy in order that they could "develop classroom talk which could be seen to construct moves towards critical reading" (p. 19). Non-critical pedagogy adopted was similar to the reader-response approaches of literature teaching in which the students were, for instance, encouraged to give personal responses to the text, asked to relate their understanding of the main character of the story and encouraged to share empathy with the characters.

In the study by McDonald (2004), the classroom talk was recorded. The transcript presented in the research report shows how uncritical thinking pedagogy was encouraged and how this led to the pedagogy of critical thinking. Even though the study did not show how the researcher measured the students' development of critical thinking skills, it, nevertheless, indicates that the use of literature can promote critical thinking, and also how non-critical thinking activities can be used as a transition to critical thinking activities. Again, this indicates that literary works could have a beneficial influence on the promotion of (young) learners' critical thinking skills if the scaffold is adequately facilitated.

Another study that supports the role of literary works in promoting students' critical thinking skills and argues for providing a scaffold to encourage the development of skills was done by Commeyras (1990). The study aimed to "provide a convincing example to illustrate the relationship between critical thinking and reading comprehension and to show that critical thinking can be promoted in everyday classroom instruction using regular classroom materials" (p. 201) and adopted an analysis of a critical thinking reading lesson. It involved eight elementary school students in Boston and the lesson was videotaped. The reading lesson was taken from a book titled *The Death of Evening Star.* Three instructions were given: (1) asked the students to read the story for comprehension, (2) asked them to complete a written assignment by preparing evidence for a hypothesis and (3) asked them to discuss the story. The scripts presented in the research report showed the students' progress in critical thinking.

Other literature has also reported that using literary works to promote critical thinking can be successful with children. Pioneering work was done by Matthew Lipman, who created Philosophy for Children (P4C) in the 1970s. Lipman's P4C program uses stories (children's novels) to promote critical inquiry by children. Other authors (e.g. Aubrey, Ghent, & Kanira, 2012; Costello, 2000; Fisher, 2008; Lam, 2012) have proved that P4C is effective to promote children's critical thinking. For example, a study by Lam (2012) reports those children in the experimental group in Hong Kong who were taught using P4C performed better than the control group in reasoning skills, which is an integral part of critical thinking.

Inspired by the effectiveness of literary works in promoting critical thinking, Fisher (2008), who argues that stories contain the elements of narrative constructions being potential for interpretation, reflection and discussion, proposes activities related to fictional works. According to Fisher (ibid), the elements of narrative construction that could promote critical thinking are contexts, temporal order, particular events, intentions, choices, meanings and the telling. The questions related to contexts refer to the historical, narrative and social contexts of the story, for instance, *What is the relationship between the characters?* (social context). While temporal order questions ask about what happened in the beginning, middle, or end of the story, questions about particular events focussing on events or episodes in the story. Intentions involves questions asking what the characters in the story think, want or believe, and meanings is concerned with the meanings in the story (e.g. *What kind of story is it?*). Questions probing choices and the telling involve the choice of actions taken by the characters in the story and whether the story is told well.

Apart from stories (short stories and novels), Fisher (2008) also argues that poetry is another literary product that can be used to encourage children's critical thinking skills. He suggests some simple poetry-based activities that a teacher can apply in the classroom. The activities start from reading the poetry aloud, followed by asking students to think and reflect on it. Then students are asked to mention interesting findings from it as ideas for discussion. The teacher can then invite or ask one of the students to comment, and then invite others to give responses. The process can be repeated and also the discussion can be expanded by asking more questions.

The strategies of Fisher (2008) seem ideal to promote children's critical thinking skills as they explore various elements of critical thinking such as questions asking for viewpoints or perspectives (*What kind of story is it?*), alternatives (*What choices or decisions had to be made?*) and clarifications (e.g. *What does 'once upon a time' mean?*). These three elements belong to the category of critical thinking questions (Paul, 1990). The strategies, however, are likely to work, not only for children but also for teenagers and adults. Indonesian students of junior and senior secondary school may get advantages from questions like these because at least they can start to think and express their opinions, apart from practising their speaking skills. With slight modifications, these strategies could be used for advanced ELT learners as well.

2.3 Literature, Critical Thinking and Tolerance

It is becoming increasingly difficult to ignore the importance of literature in ELT. As mentioned, apart from giving manifold benefits for language learners such as culture and authentic materials, literature can also be used to teach critical thinking. When ELT is infused with critical thinking pedagogy, there would be two advantages. Firstly, students may improve their language proficiency. Secondly, their critical thinking skills may be enhanced. However, as has been mentioned literary criticism is getting unpopular in ELT curriculum due to possibly the influence of the communicative approach. As regards this, Ghosn (2002) states that using literature in the ELT classroom has potential for promoting empathy and tolerance, which could decrease prejudice; unfortunately, recent ELT programmes have very little attention to this aspect.

Connected to the Indonesian context, the academic judgment by Ghosn (2002) seems very suitable to Indonesian conditions nowadays in which there are still many people who are not very tolerant of differences. Living in a very pluralistic society like Indonesia, people need to respect and appreciate differences, including differences in ideology, opinions and/or viewpoints. As reported by Indonesian media, conflicts concerning racial problems and violence respecting religious beliefs sometimes happen in the country. For example, a liberal Canadian Muslim activist Irshad Manji was attacked by Islamic hardliners/read fanatics during her book discussion in Yogyakarta, Indonesia (www.thejakartapost.com). For those being against the book, it was believed to be far away from mainstream Islamic teachings. This is absolutely based on the attackers' assumption as they had never read Manji's book. The incident appears to be uncivilized, and it is very far from 'tolerant' which is one of our educational objectives. Dialogue is not appreciated by these militants. These fanatics are not taught to counter argument with argument. Differences of opinion usually end up with a physical attack.

Introducing critical thinking may help to bring about tolerant attitudes amongst students since in critical thinking students are taught how to see a problem from different viewpoints as noted in Paul and Elder's (2006) conception of critical thinking above. Different viewpoints can then be examined, evaluated and criticised in order to make sound academic judgments. One form of critical thinking activities is dialogical critical thinking. During dialogical critical thinking, students are asked to comment on somebody else's comment (this is also part of a poetry-based activity proposed by Fisher (2008) above). The students get involved in a dialogue to find out what others think and feel, consider various perspectives, share ideas, and reflect on their own thinking. This is done with a spirit of respect, so that the students will learn that there are actually many perspectives of seeing a problem, and having a different opinion is not problematic at all. This may help to create tolerance at the end and certainly supports the objectives of education in Indonesia. Besides this, the students are expected to learn not to be easily manipulated by hardliners with extremist political propaganda.

With regard to Ghosn's (2002) ideas, promoting tolerance can be done through the teaching of literature. Through human suffering and the experiences of its characters, literature teaches people to be more humane, promoting empathy and respect. Besides this, in the context of ELT, literature brings many very positive effects in such aspects as language proficiency and critical thinking. As mentioned, studies have proven that

promoting critical thinking can be done through literature. Conditions in Indonesia need people who can appreciate different points of view, thus promoting tolerance. Therefore, retaining literature in the Indonesian ELT curriculum may help bring about three very important positive effects: (1) better language proficiency, (2) improved ability in critical thinking, and (3) increased tolerance.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

The literature has reported that there is a strong relationship between the teaching of literature and the development of critical thinking and enhanced tolerance. Literature can give a lot of benefits to ELT learners such as language enrichment, culture enrichment and authentic materials. The teaching of literature can also improve learners' critical thinking skills as stories can be used to explore students' viewpoints or perspectives; thus encouraging them to voice their opinions and to build up their self-confidence. Besides this, critical thinking can promote tolerance; this can be done through dialogical critical thinking activities. In a dialogical critical thinking activity, students are given a (controversial) topic and asked to comment; a teacher needs to further explore their comments and make sure that their beliefs are not actually only based on wrong assumptions and fears. All of this has important implication for retaining literature in the Indonesia ELT curriculum because both critical thinking and tolerance are two qualities included as educational objectives in the Regulations of the Republic of Indonesia Number 17, Year 2010 Regarding Educational Management and Administration.

3.2 Recommendations

The big issue emerging from the conclusion above relates specifically to Indonesian ELT textbooks and teachers. Textbooks need to include activities or tasks promoting critical thinking skills, while Indonesian school teachers need to understand how to teach literature and promote critical thinking through literary-based activities. It can thus be suggested that English textbook writers (and/or publishers) need to include activities or tasks that will facilitate the development of critical thinking skills amongst students, and Indonesian schoolteachers need further training in this field. The teachers also need to be reminded that one of the educational objectives in Indonesia is producing graduates who are, among other things, critical and tolerant. Criticality is a skill needed in this globally changing world, and tolerance is needed to sustain democracy in the country and to curb violence as a result of differences in our very pluralistic country. Retaining literature in the Indonesian ELT curriculum therefore may be one of the ways to implement this objective of education and to improve the quality of our human resources in order to be able to compete with other people in the world.

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DESIGNING READING MATERIALS FOR TELECOMMUNICATIONS ENGINEERING

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ABSTRACT

The study attempts to design reading materials for telecommunications engineering. To produce satisfactory teaching materials, the writer did the steps as follows: doing needs analysis, reviewing the principles of materials design and reading in a foreign language, designing course framework, designing syllabus, designing reading materials, and implementing the sample lessons. The instruments used were questionnaire and interview. The results of need analysis, along with the principles of materials design and reading in a foreign language, became the basis for course design framework. Furthermore, the framework was developed into a syllabus that became the basis for designing reading materials. The syllabus applied topical category, so each lesson had different topic, ranging from internet, satellite, optical fiber, cellular phone, antenna, modem, to GSM and CDMA technology. When the materials had been designed, the writer implemented six out of ten units of the coursebook. The result was quite satisfactory. The majority of students said that the materials were relevant, understandable and interesting.

Keywords: needs analysis, materials design, reading in a foreign language, English for Specific Purposes (ESP).

ABSTRAK

Penelitian ini bertujuan untuk merancang bahan ajar keterampilan membaca di jurusan teknik telekomunikasi. Untuk menghasilkan materi yang memuaskan, peneliti melakukan beberapa langkah: analisa kebutuhan, melakukan 'review' terhadap prinsip-prinsip pengembangan materi serta prinsip-prinsip membaca dalam bahasa asing, merancang kerangka mata kuliah, merancang silabus, membuat bahan ajar, dan mengujicobakan bahan ajar tersebut. Instrumen yang digunakan adalah 'questionnaire' dan wawancara. Hasil dari analisa kebutuhan dan prinsip-prinsip dalam pengembangan materi dan membaca dalam bahasa asing menjadi dasar bagi kerangka rancangan. Kerangka tersebut kemudian dikembangkan menjadi silabus sebagai dasar untuk mengembangkan materi keterampilan membaca. Kategori silabus yang digunakan adalah topical (topical category), sehingga setiap unit memiliki topik berbeda mulai dari internet, satelit, serat optik, telephon seluler, antenna, modem, dan teknologi GSM dan CDMA. Setelah materi ajar selesai dibuat, peneliti melakukan implementasi 6 unit dari 10 unit modul kuliah (coursebook). Hasil dari implementasi cukup memuaskan. Sebagian besar mahasiswa mengatakan bahwa materi tersebut relevan, menarik, dan mudah dimengerti.

Kata Kunci: analisa kebutuhan, disain materi, Membaca dalam bahasa asing, Bahasa Inggris untuk tujuan khusus

Indonesia, one of developing countries in the world, has realized the importance of learning English is not only to get knowledge, science and technology but also to communicate with foreign people as well as promote cultures. That is why the language has been taught at formal schooling, starting from elementary to university levels. At a university level, English is mostly taught for the purpose of making students able to read English textbooks. This is important to support the students' research when writing a final project as one of the requirements to finish their education. They need to read more books and scientific journals to find the underlying theories on the topic they are writing or researching.

A number of ready made English textbooks for classroom use are a lot. Some big publishers such as Longman, Cambridge, and Pearson have published English textbooks for various fields of study, ranging from economics to engineering. English lecturers just pick one and apply it in the classroom. They do not have to worry about framework since most English textbooks are written by the experts, and ready made textbooks usually provide clear framework. Ur (2000) explains, "One of the advantages of using ready-made materials is its practicality".

Apart from the advantages, commercial materials also have drawbacks and one of them is that they do not always fulfill what English learners need. In Indonesia, English proficiency of learners especially at a university level is varied and diverse. Commercial materials are not always capable of catering the diversity. This is similar to what Nunan (1995) says that "one of the major concerns is that any given coursebook will be incapable of catering for the diversity of needs which exists in most language classroom."

In the field of English for Specific Purposes (ESP), the problems are almost similar. Commercial textbooks available in the market are mostly incapable of catering the learners' needs. Very often the contents of commercial ESP textbooks do not match certain conditions, such as the needs of learners and the level of difficulty. Bouzidi (2009) asserts that "an important component of an effective ESP course is a textbook that contains job-related English lessons. However, there is often a mismatch between the content of ESP textbooks and actual workplace demand."

The unsatisfactory fulfilment of commercial textbooks in catering the needs of students and stakeholders spurred the writer to do the study on designing teaching materials for telecommunications engineering at Telkom academy in Jakarta. This article describes the steps in designing the teaching materials focusing on reading in a foreign language.

The Importance of English for the Students Majoring Telecommunications Engineering

The development of telecommunication technology is very fast in Indonesia. It is estimated that Indonesia will rank number 3 of most cellular phone users around the world. To anticipate such rapid development, some higher institutions in Indonesia open a major specializing in telecommuni-

cations under faculty of engineering. This is actually in line with the ever-growing number of telecommunication companies operating in the country. With the population reaching more than 238 million people, the country is a promising market for investment in telecommunication business.

Since telecommunications is a relatively new field of study in Indonesia, textbooks written in Indonesian language are still very rarely. The textbooks are mostly in English. On the one hand the English textbooks are still difficult for most Indonesian students, and this hampers them to read and understand the textbooks thoroughly, but on the other hand they have to find references to support their project by the end of their study. Reading materials that can equip them to be able to read English textbooks are highly needed.

However, there are some problems encountered in teaching English for students majoring in telecommunications engineering. The problems are, among other things, unavailable suitable reading materials or coursebook and limited number of meeting sessions. English is only taught for 100 minutes per week, and in one semester the meeting sessions are only 14 times.

Steps in designing the materials

Step 1: Needs Analysis

Needs analysis is the key in ESP course design. Today's concept of needs analysis, according to Dudley-Evans and St. John, includes some aspects. First aspect is professional information about the learners. This is to find out the task and activities what the learners are using English for and what they will be using English for. Second aspect is personal information about the learners. This is to see factors that may affect the way the learners learn. Those factors encompass previous learning experiences, cultural information, reasons for attending the course and the expectation of the course, and attitude to English as a target language.

Third aspect concerns English language information about the learners. The information needed is to find out the learners' current skills and their present language use. Fourth aspect is language learning information. This is done to find out the effective ways of learning the skills and language. Fifth aspect is information about knowledge of how the language is used in the target situation. Sixth aspect is to find out what is wanted from the course, and final aspect is information concerning the environment in which the course will be run.

Graves (2000) proposes the process of needs assessment. She states that "the process of needs assessment involves a set of decisions, actions, and reflections that are cyclical in nature. The cyclical process starts from deciding what information to gather and why, deciding the best way to gather it: when, how and from whom, gathering the information, acting on information, evaluating the effect and effectiveness of the action, and finally back to number one to decide on further or new information to gather."

The next question is who provides the data and how? Regarding this, Dudley-Evans and St John (2002) suggest that for needs analysis the main sources to collect the data are the learners, people working or studying in the field, ex-students, document relevant to

the field, clients, employers, colleagues, and ESP research in the field.

By doing needs analysis, the writer intended to find out what the students need and the subjects the students learn from the institution in order to produce adequate reading materials. The writer also administered questionnaires to alumni and stakeholders (institution and telecommunication companies that have ever recruited the telecommunications engineering graduates). Finding out what alumni and stakeholders want from English lesson could benefit in designing the teaching materials. At least the writer knows the expectation of other parties - apart from the students themselves - and could cater the expectation.

There are some purposes of doing needs analysis. Richards (2007) states that "needs analysis in language teaching may be used for a number of purposes such as to collect information about particular information and about a particular problem learners are experiencing, and to identify a gap between what students are able to do and what they need to be able to do."

The points the writer wanted to find out from needs analysis activity for students were problems the students faced in understanding and interpreting the text, how important English for the students' success in their study and future, how difficult the English texts (journals, newspaper and internet articles, textbooks) for the students, what kinds of text the students wanted to learn in the classroom, and what reading strategies (skimming, scanning, guessing meaning from context, making inferences) the students usually did in understanding English texts or passages.

In doing needs analysis for alumni, the points the researcher wanted to find out were how often they found difficulty in reading, writing, speaking, and listening in English, how important English for their success in career, what difficulties they encountered when reading English texts as well as speaking and writing in English. Needs analysis done for stakeholders aimed to find out English language skills they expected from the graduates of telecommunications engineering. Following are some important results from needs analysis activity:

- Most students said they found difficulty in understanding English texts (textbooks and journals), but most of them said that reading, writing, speaking, and listening were important for their success in study and for their future.
- Most students wanted to learn texts taken from internet, textbook, journal, and newspaper. Only a few students wanted to learn fiction. Most of them do not understand reading strategies such as skimming, scanning, etc in comprehending reading texts.
- Most alumni said that they found difficulty in speaking, but most of them said all four skills were important for their career. The problem mostly found in English was related to lack of vocabulary. In speaking, the problem was mostly pronunciation.
- The institution wanted its students to be able to read textbooks in order that they could find resources for underlying

theories when doing their final project and to make the students accustomed to English textbooks, so indirectly it would improve their speaking and writing skill.

- Since most graduates work as technicians, companies required the graduates who had a good command of reading manual. The graduates were also expected to have a writing ability, especially in writing a report.

Step 2: Designing Course Framework

Based on the results of needs analysis, the writer then identified the global aim of the course, namely enhancing reading skills and introducing the elements of linguistic input and subject input. Thereby the writer designed a course framework. This course framework contained general points of reading themes and topics, information of classroom activities that followed up reading, the length of study session, the number of the course meetings, and the number of participants. This course framework became the basis to write the syllabus. The following table lists points contained in the course framework.

Table 1: Course Framework

Course Framework
DEFINITION: English for Telecommunications Engineering "English for Telecommunications Engineering" aims for equipping students of Department of Telecommunications Engineering to be able to read English textbooks. By having reading skills, they are expected to get broader knowledge about their field of study and find sources to support their research for a final project. The course also gives chances for the students to practice speaking and writing.
DELIVERY: Discussion, Lecture, Practice In delivering the course, the lecturer starts with eliciting the students' knowledge about the topic. Then the students are exposed with the reading passages to know more about the topic being discussed. To understand the reading passages, the lecturer explains the reading strategy/skill. After that the students are asked to practice the skill. After the reading skills are practiced, the students are given speaking and/or writing activities as follow up activities.
INTENSITY: The materials are for one semester (16 meetings). Each meeting lasts for 100 minutes that is done once a week. There is a mid-term test on the eighth meeting and final test on the last meeting. The quiz is given before mid-term test and final test to check the students' understanding of the materials having been learned.

PARTICIPANT:

The participants are first-semester students. They are all high school graduates who have known basic knowledge of English. Overall their language proficiency is considered between elementary and pre-intermediate levels. There are two classes in each semester. In one class there are about 35-40 students.

CONTENT: Topics of Telecommunications Engineering

The materials include various topics in the field of telecommunications engineering. The topics cover:

- meaning, history, and purpose of telecommunications
- telegraph
- telephone
- radio
- television
- internet
- satellite

For reading skills or strategies, the materials include:

- skimming
- scanning
- guessing word meaning in context
- making inferences
- building vocabulary

By the end of the lesson, there is 'Expansion'. This includes speaking and writing activities.

OUTCOME:

Upon completing the course, students are expected to be able to:

- know skimming skill to understand English texts
- know scanning skill to understand English texts
- guess meaning of words in English texts
- recognize word referent
- make inferences from English texts
- build their vocabulary
- express their ideas
- write a simple report
- develop good reading habit

Step 3: Designing a Syllabus

Based on the course framework, the writer designed a reading syllabus. The syllabus outlined coursebook in detail concerning reading texts and classroom activities and strategies. The syllabus also acted as guidance for selecting and producing reading materials that are really suitable to lesson objectives.

There are five assumptions underlying early approaches to syllabus design. Those approaches to syllabus, according to Richards (2007), emerged in the first part of the twentieth century. Up to now, the assumptions partly still become the guideline for materials design and development. First assumption of approaches to syllabus design is the basic units of language are vocabulary and grammar. Richards (2007) states "the traditions approached the teaching of English largely through its vocabulary and grammar. Although the role of speaking and pronunciation were not ignored during the actual teaching of the language, the priority in planning was vocabulary and grammar and these were seen as the main building blocks of language development."

Second assumption is learners everywhere have the same needs. Language teaching mainly focuses on General English. So it was believed that core vocabulary of GE, together with grammatical syllabus, would serve as the basis for almost all language courses. Third assumption is learners' needs are identified exclusively in term of language needs. Syllabus design is solely based on language needs of learners. By grasping the language competency, the learners are expected to be able to solve their language barriers. Richards (2007) asserts that "no matter who the learners are or the circumstances of their learning, it is assumed that mastery of English will solve their problems. The goal of English teaching is to teach them English - not to teach them how to solve their problems through English."

Fourth assumption is the process of learning a language is largely determined by the textbook. Textbooks are believed to be the primary input for learners to get from the language learning process. Fifth assumption is regarding to the context of teaching. The context of teaching in the writer's syllabus designing is English as a foreign language in the field of English for Specific Purposes (ESP).

Compared to curriculum, syllabus nowadays becomes the central point of teaching-learning activity. Rodgers (1994) states that "until fairly recently most educational authorities have considered the *syllabus* to be the educational program. It has been the syllabus which has received the most attention in educational design and implementation. It has been syllabus reform which has been seen as central to educational reform. When new educational goals are sought or old goals are felt to have been inadequately realized, specification of a new syllabus has been the typically favored solution."

There are some categories of syllabus, i.e. structural, situational, topical, skills, and task. Since the teaching materials the writer designed is reading for telecommunications engineering, the syllabus concerning 'topical' seemed to be the most appropriate. The reason is because there are lots of topics in

light of telecommunications, such as history, radio and television, computer networks and internet, telephone, satellite, modem, etc.

The idea of taking topical syllabus for designing reading materials for telecommunication engineering seems to be appropriate to what Brown (1995) states that "topical syllabuses are organized by topics or theme, rather than situations. Typically, the topics are selected by the textbook author on the basis of his or her sense of the importance of the topics or theme to the lives of the students for whom the text is designed. The topics can also be sequenced on the basis of the relative difficulty of the reading passage involved." The table below shows the syllabus.

Table 2: Syllabus

Lesson and Topic	Reading Skill Objective	Building Vocabulary	Expansion
1 Introduction to telecommunication and means of communication (telegraph, telephone, radio, television)	Skimming	Matching	Discussion and presentation
2 Internet	Scanning	Filling in the blanks	Discussion and presentation
3 Satellite	Guessing word meaning in context and recognizing word referent	-	Writing an essay
4 Computer	Making inferences	Filling in the blanks	Giving presentation about computer
5 Optical fiber	Skimming	Finding the synonym of words	Group presentation
6 Radar	Scanning	Filling in the blanks	Writing an essay about radar
7 Antenna	Guessing word meaning in context and recognizing word referent	Filling in the blanks	Writing a report

8 Cellular phone	Making inferences	Matching the terms of cellular phone with their definition	Writing, discussing, debating
9 GSM and CDMA technology	Skimming and scanning	-	Writing, discussing, presenting
10 Modem	Guessing word meaning in context, recognizing word referent, and making inferences	Filling in the blanks	Writing an essay

Step 4: Designing Materials for Reading

Based on the syllabus, the writer then designed materials that can be used by the students majoring in telecommunications engineering. In designing the materials, the principles of material design and the principles of reading in a foreign language became the main priority and the focus of attention as a reference.

Principles of Materials Design

In ESP context, materials play an important role. Apart from becoming a teaching-learning source, materials can act as reference. Dudley-Evans and St John (2002) assert that there are four reasons for using materials which seem significant in the ESP context. First reason is materials act as a source of language. In some situation in which English is a foreign language, not a second language like in Indonesia, English is the only source. In this context materials play a crucial role in exposing learners to the language.

Second reason is materials have a role as a learning support. As a learning support, according to Dudley-Evans and St John (2002), "materials need to be reliable, that is, to work, to be consistent and to have some recognizable pattern." Third reason is materials can be for motivation and stimulation, and the last reason is materials can be used for a reference.

Due to the characteristics of ESP which focuses on specialist subjects and unavailable commercial materials in the market, very often ESP teachers need to design or develop the materials themselves. In fact, there are some advantages of creating our own teaching materials. Richards (2007) mentions four advantages of creating our own materials.

First advantage is relevance. Materials can be produced that are directly relevant to the students and institution's need. Using available commercial textbook does not guarantee this relevance. Second advantage is developing expertise. Third advantage is reputation. The institution that creates its own materials will be more acknowledged that the one using commercial materials available in the market. The last advantage of creating our own materials according to Richards is flexibility. Materials that are pro-

duced by the institution can be revised or adapted quickly as needed. They are more flexible than commercial course books.

Principles of Reading in a Foreign Language

There are some approaches regarding reading in a foreign language. They are bottom-up, top-down, and interactive approach. In a bottom-up approach, the readers will do a series of stages to comprehend reading texts. Hudson (2007) states that "bottom-up approaches assume that a reader construct meaning from letters, words, phrases, clauses, and sentences by processing the text into phonemic units that represent lexical meaning, and then build meaning in a linear manner."

Contrary to bottom-up approach, top-down approach can be illustrated as a person who tries to understand an area from the air by getting a thorough picture of it. The readers use their intelligence and experience to understand a reading passage. This is similar to what Nuttal (2000) states that "in top-down processing, we draw on our intelligence and experience - the prediction we can make, based on the schemata we have acquired - to understand the text."

The last approach is interactive. Interactive approach is the combination of those two approaches. Nuttal (2000) asserts that "in practice a reader continually shifts from one focus to another, now adopting a top-down approach to predict the probable meaning, then moving to the bottom-up approach to check whether that is really what the writer says." Since it is clear that the combination of two approaches will give more benefit to the students, the reading materials the writer designed adopted interactive approach.

Based on the approach, there should be activities pertaining to reading skills and strategies to enable students to develop skills and strategies which facilitate reading comprehension. Grabe (1986) states that "the types of materials for reading instruction should include guessing from context, skimming and scanning (skimming is reading quickly for main idea, while scanning is looking for specific information in the passage), vocabulary development, and extensive outside reading materials."

Step 5: Implementation

After designing the lessons, the writer did the implementation. The purpose of doing the implementation was to find out the responses of the students toward the materials having been designed. The writer only implemented 6 out of 10 units with the reason that lessons 7 - 10 were only repetition, meaning that the reading skills had been discussed and practiced in the previous lessons. The difference is only for the reading texts. By so doing, implementing six lessons in the writer's opinion already represented the whole coursebook.

The writer distributed questionnaires after implementing each lesson. The points of the questionnaires were whether the materials were suitable to the students' field of study or not, whether the materials were understandable or not, whether the materials were interesting for the students or not, whether in general the materials were satisfactory or not, and comments from the students for material improvement.

FINDINGS AND DISCUSSIONS

All respondents said that lesson 1 was related to telecommunications engineering. 83% of the students said that the lesson was understandable. 67% said that the lesson was interesting, and 67% mentioned that they were satisfied with the lesson. Concerning lesson 2, 96% of the students said lesson 2 was related to their field of study, and only 4% said that it was not related. 73% of the students said lesson 2 was understandable. 93% said it was interesting, and 73% of the students said that they were satisfied with lesson 2.

For lesson 3, all students said that it was related to the subject they were learning. 64% of the students said it was understandable, and 88% of the students said it was interesting. 68% of the students said they were satisfied with lesson 3. With respect to lesson 4, all students also said that the lesson was related to telecommunications engineering. 88% of the students said this lesson was understandable, and 77% of the students said it was interesting. 74% of the students mentioned that the lesson was satisfying.

As regard to lesson 5, 100% of the students said it was related to the subject they were studying. 85% of the students said the lesson was understandable and interesting, while 74% of the students said lesson 5 was satisfactory. For lesson 6, similar to previous lessons, all students said it was related to the subject they were studying. 88% of the students said it was understandable. 77% of the students mentioned that lesson 6 was interesting, and they were satisfied with the lesson. Overall majority of the students said that the six lessons were related to their field of study, understandable, interesting, and satisfactory. It proves that the reading materials the writer designed was quite successful.

SUGGESTIONS

Based on the findings of research, materials design, and implementation, the writer found out some points. First, in making questionnaires for needs analysis, the questions must be very clear to the informants and must ask questions that are related to the planned materials. The questions can cover the background information of the informants, the present information of the informants, what the informants really expect from the lesson, and what they expect in the future.

Second, stakeholders must also be the priority, especially in the field of ESP. The information they give will surely be beneficial for designing teaching materials. Their presence cannot be ignored since they are the ones who will recruit or hire the students. There must be a link between what the students learn in the classroom with what they will do later in the work place. If possible, cater all the needs from all parties to make the teaching materials more useful and beneficial.

Third, in designing reading materials for telecommunications engineering, the underlying theories on principles of reading in a foreign language and principles of designing teaching materials must be highlighted very seriously. Combining the principles and the findings from needs analysis becomes the basis for material development.

Finally, take the implementation seriously. Through this activity, the designer of the teaching materials can see whether the materials are successful or not in catering the needs of the students. During this activity, the designer not only sees the results of the questionnaires given back after the lesson but also pays attention to the students' reaction, comments, and responses. Sometimes such responses can give more information rather than what the students write on a piece of paper.

CONCLUSION

Designing our own materials can give some advantages for a teacher, students, and stakeholders. Some steps to produce satisfactory reading materials are doing needs analysis to all parties involved in teaching-learning process, designing course framework, designing a syllabus, designing the materials, implementation, and evaluation. In designing such materials, a designer should pay attention to the principles of materials design and principle of reading in a foreign language.

Finally, materials design is an on-going process. There is always revision, starting from needs analysis to implementation. Even, when the materials are already used, still there must be revision in accordance with the development of science and technology. In terms of telecommunications engineering in which the subject and new invention change very quickly, the materials must change and be revised. So, the materials can keep up with the development of science and technology.

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APPENDICES

The example of units in designing reading materials for telecommunications engineering

Lesson One

GENERAL OBJECTIVE

After learning this lesson, students are expected to understand 'skimming' skills

SPECIFIC OBJECTIVES

After learning this lesson, students are able to:

(1) use 'skimming' skill in reading English texts

(2) explain about telecommunication and means of communication in English

(3) talk about negative effects of television programs for kids

A. Discuss the following questions.

1. What do you understand about *telecommunication*?
2. Can you name some traditional means of communication?
3. Why do people no longer use those means of communication?
4. What do you know about telegraph?
5. What do you know about telephone?
6. What do you understand about radio and television?

B. Reading Skill: Skimming

Skimming is the technique to help you catch the main idea of a paragraph/passage quickly or to get the general sense/ideas of a paragraph, passage, article, or book. When you skim, always work as quickly as you can and do not worry about specific details. For example, answer this question: What is the paragraph below about?

The telecommunication industry is divided into four main sectors: wired, wireless, satellite, and other telecommunications establishment. The largest sector of the telecommunications industry continues to be made up of wired telecommunications carriers. Establishments in this sector mainly provide telecommunications services such as wired (landline) telephone, digital subscriber line (DSL) internet, and cable TV and internet services. These organizations route TV, voice, internet, data, and other content over a network of wires and cables, and control access to this content. They may own and maintain networks, share networks with other organizations, or lease network capacity from other companies. Establishments in the telecommunications industry, however, do not create the content that is transmitted over their networks such as TV programs. Wired telecommunications also includes direct-to-home satellite television distributors and a variety of other businesses. (adopted from http://www.bls.gov/oco/cg/cgs020.htm)

The first sentence of the paragraph states "The telecommunications industry is divided into four main sectors: wired, wireless, satellite, and other telecommunications establishments." The next sentences mostly talk about 'wired telecommunication' that is part of telecommunications industry. So, we can conclude that the paragraph is about telecommunication industry.

C. Reading

1. Read these questions and then skim passage 1.

1. What is telecommunications?

   _____

   _____

   _____

2. How did people communicate in the Middle Ages?

   _____

   _____

   _____

3. How do people communicate in this modern age?

   _____

   _____

   _____

4. How did telecommunication revolutionize?

   _____

   _____

   _____

Passage 1
What is Telecommunication?

Telecommunication is the *transmission* of messages over significant distances for the purpose of communication. In earlier times, telecommunications involved the use of visual smoke signals, *semaphores*, signal flags, the optical *heliograph*, or audio coded messages sent by drumbeats, messages sent with lung-blown horns, or messages sent by loud whistles, for example.

The image of Native Americans communicating by creating a smoke signal

In the Middle Ages, chains of *beacons* were commonly used on hilltops as a means of relaying a signal. Beacon chains suffered the drawback that they could only pass a single bit of information, so the meaning of the message such as "the enemy has been sighted" had to be agreed upon in advance. One notable instance of their use was during the Spanish Armada, when a beacon chain relayed a signal from Plymouth to London that signaled the arrival of the Spanish warships.

In the modern age of electricity and electronics, telecommunications has typically involved the use of electric means

such as the telegraph, the telephone, the *teletype*, the use of *microwave communications*, the use of fiber optics and their associated electronics, and/or the use of the internet. The first breakthrough into modern electrical telecommunications came with the development of the telegraph during the 1830s and 1840s. The use of these electrical means of communications exploded into use on all of the continents of the world during the 19th century, and these also connected the continents via cables on the floors of the ocean. These three systems of communications all required the use of conducting metal wires.

A revolution in telecommunications into wireless communications began in the first decade of the 20th Century, and in fact, Guglielmo Marconi, who was of Italian and British descent won the Nobel Prize in Physics in 1909 in recognition of his pioneering developments in wireless radio communications. Other early inventors and developers in the field of electrical and electronic telecommunications include Samuel F.B. Morse and Joseph Henry of the United States, Alexander Graham Bell of Canada, Lee de Forest of the U.S., who invented the amplifying vacuum tube called the triode, Edwin Armstrong of the U.S., and John Logie Baird of England. (adopted from http://en.wikipedia.org/wiki/Telecommunication)

2. Read these questions and then skim passage 2.

1. What do you know about the first electrical telegraph?

   _____
   _____
   _____

2. What did Morse and Henry do regarding the telegraph?

   _____
   _____
   _____

3. What is the effect of permanent transatlantic telegraph?

   _____
   _____
   _____

4. What caused transatlantic cable fail?

   _____
   _____
   _____

5. Who is Alexander Graham Bell?

   _____
   _____
   _____

Passage 2
The Telegraph and the Telephone

The first commercial *electrical telegraph* was constructed by Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use began on April 9, 1839. Both Wheatstone and Cooke viewed their device as "an

improvement to the [already-existing, so-called] electromagnetic telegraph" not as a new device.

The businessman Samuel F.B. Morse and the physicist Joseph Henry of the United States developed their own, simpler version of the electrical telegraph, independently. Morse successfully demonstrated this system on September 2, 1837. Morse's most important technical contribution to this telegraph was the rather simple and highly-efficient Morse Code, which was an important advance over Wheatstone's telegraph system. The communications efficiency of the Morse Code anticipated that of the Huffman code in digital communications by over 100 years, but Morse had developed his code purely empirically, unlike Huffman, who gave a detailed theoretical explanation of how his method worked.

The first permanent transatlantic telegraph cable was successfully completed on 27 July 1866, allowing transatlantic electrical communication for the first time. An earlier transatlantic cable had operated for a few months in 1859, and among other things, it carried messages of greeting back and forth between President James Buchanan of the United States and Queen Victoria of the United Kingdom.

However, this transatlantic cable failed soon, and the project to lay a replacement line was delayed for five years by the War Between the States in the U.S. Also, note that these transatlantic cables would have been completely incapable of carrying telephone calls even if the telephone had been invented by then. The first transatlantic telephone cable (which incorporated hundreds of *electronic amplifiers*) was not ready to be used until 1956.

The conventional telephone now in use worldwide was first patented by Alexander Graham Bell in March 1876. That first patent by Bell was the *master patent* of the telephone, from which all other patents for electric telephone devices and features flowed. Credit for the invention of the electric telephone has been frequently disputed, and new controversies over the issue have arisen from time-to-time. As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on *voice transmission over a wire*, and then improved on each other's ideas. However, the really important innovator was Mr. Bell, who first made the telephone utility into a big business with his Bell Telephone Company in the United States, and with Bell Canada. (adopted from http://en.wikipedia.org/wiki/Telecommunication)

3. Read these questions and then skim passage 3.

1. How can people communicate through analog telephone?

   _____
   _____
   _____

2. How does analog telephone work?

   _____
   _____
   _____

3. How is the development of mobile phones in the world?

   _____
   _____
   _____

4. What is the benefit of communicating with optic fibres?

   _____
   _____
   _____

5. What is ATM protocol suitable for?

   _____
   _____
   _____

Passage 3

Telephone

In an analog telephone network, the caller is connected to the person he wants to talk to by switches at various *telephone exchanges*. The switches form an electrical connection between the two users and the setting of these switches is determined electronically when the caller dials the number. Once the connection is made, the caller's voice is transformed to an electrical signal using a small microphone in the caller's handset. This electrical signal is then sent through the network to the user at the other end where it is transformed back into sound by a small speaker in that person's handset. There is a separate electrical connection that works in reverse, allowing the users to converse.

The *fixed-line* telephones in most residential homes are analog — that is, the speaker's voice directly determines the signal's voltage. Although short-distance calls may be handled from end-to-end as analog signals, increasingly telephone service providers are transparently converting the signals to digital for transmission before converting them back to analog for reception. The advantage of this is that digitized voice data can travel side-by-side with data from the internet and can be perfectly reproduced in long distance communication (as opposed to analog signals that are inevitably impacted by noise).

Mobile phones have had a significant impact on telephone networks. Mobile phone subscriptions now outnumber fixed-line subscriptions in many markets. Sales of mobile phones in 2005 totalled 816.6 million with that figure being almost equally shared amongst the markets of Asia/Pacific (204 m), Western Europe (164 m), CEMEA (Central Europe, the Middle East and Africa) (153.5 m), North America (148 m) and Latin America (102 m). In terms of new subscriptions over the five years from 1999, Africa has outpaced other markets with 58.2% growth. Increasingly these phones are being serviced by systems where the voice content is transmitted digitally such as *GSM* or *W-CDMA* with many markets choosing to

depreciate analog systems such as AMPS.

There have also been dramatic changes in telephone communication behind the scenes. Starting with the operation of TAT-8 in 1988, the 1990s saw the widespread adoption of systems based on optic fibers. The benefit of communicating with optic fibers is that they offer a drastic increase in data capacity. TAT-8 itself was able to carry 10 times as many telephone calls as the last copper cable laid at that time and today's optic fiber cables are able to carry 25 times as many telephone calls as TAT-8. This increase in data capacity is due to several factors: First, optic fibers are physically much smaller than competing technologies. Second, they do not suffer from crosstalk which means several hundred of them can be easily bundled together in a single cable. Lastly, improvements in *multiplexing* have led to an exponential growth in the data capacity of a single fiber.

Assisting communication across many modern optic fiber networks is a protocol known as *Asynchronous Transfer Mode (ATM)*. The ATM protocol allows for the side-by-side data transmission mentioned in the second paragraph. It is suitable for public telephone networks because it establishes a pathway for data through the network and associates a *traffic contract* with that pathway. The traffic contract is essentially an agreement between the client and the network about how the network is to handle the data; if the network cannot meet the conditions of the traffic contract, it does not accept the connection. This is important because telephone calls can negotiate a contract so as to guarantee themselves a constant bit rate, something that will ensure a caller's voice is not delayed in parts or cut-off completely. There are competitors to ATM, such as *Multiprotocol Label Switching (MPLS)*, that perform a similar task and are expected to supplant ATM in the future.

(adopted from http://en.Wikipedia.org/wiki Multiprotocol_Label _Switching)

4. Read these questions and then skim passage 4.

1. How does a broadcast system work?

   _____
   _____
   _____

2. What is the main advantage of digital compared to analog broadcasts?

   _____
   _____
   _____

3. What do the three digital broadcasting standards have in common?

   _____
   _____
   _____

4. Which country has ended analog television transmission?

   _____
   _____
   _____

Passage 4
Radio and Television

In a broadcast system, the central high-powered broadcast tower transmits a high-frequency electromagnetic wave to numerous low-powered receivers. The high-frequency wave sent by the tower is modu-

lated with a signal containing visual or audio information. The receiver is then tuned so as to pick up the high-frequency wave and a demodulator is used to retrieve the signal containing the visual or audio information. The broadcast signal can be either analog (signal is varied continuously with respect to the information) or digital (information is encoded as a set of discrete values).

The broadcast media industry is at a critical turning point in its development, with many countries moving from analog to digital broadcasts. This move is made possible by the production of cheaper, faster and more capable integrated circuits. The chief advantage of digital broadcasts is that they prevent a number of complaints with traditional analog broadcasts. For television, this includes the elimination of problems such as snowy pictures, ghosting and other distortion. These occur because of the nature of analog transmission, which means that perturbations due to noise will be evident in the final output. Digital transmission overcomes this problem because digital signals are reduced to discrete values upon reception and hence small perturbations do not affect the final output. In a simplified example, if a binary message 1011 was transmitted with signal amplitudes [1.0 0.0 1.0 1.0] and received with signal amplitudes [0.9 0.2 1.1 0.9] it would still decode to the binary message 1011 — a perfect reproduction of what was sent. From this example, a problem with digital transmissions can also be seen in that if the noise is great enough it can significantly alter the decoded message. Using forward error correction a receiver can correct a handful of bit errors in the resulting message but too much noise will lead to incomprehensible output and hence a breakdown of the transmission.

In digital television broadcasting, there are three competing standards that are likely to be adopted worldwide. These are the ATSC, DVB and ISDB standards. All three standards use MPEG-2 for video compression. ATSC uses Dolby Digital AC-3 for audio compression, ISDB uses Advanced Audio Coding (MPEG-2 Part 7) and DVB has no standard for audio compression but typically uses MPEG-1 Part 3 Layer 2. The choice of modulation also varies between the schemes. In digital audio broadcasting, standards are much more unified with practically all countries choosing to adopt the Digital Audio Broadcasting standard (also known as the Eureka 147 standard). The exception being the United States which has chosen to adopt HD Radio. HD Radio, unlike Eureka 147, is based upon a transmission method known as in-band on-channel transmission that allows digital information to "piggyback" on normal AM or FM analog transmissions.

However, despite the pending switch to digital, analog television remains being transmitted in most countries. An exception is the United States that ended analog

television transmission (by all but the very low-power TV stations) on the 12th of June 2009 after twice delaying the switch over deadline. For analog television, there are three standards in use for broadcasting color TV. These are known as PAL (British designed), NTSC (North American designed), and SECAM (French designed). (It is important to understand that these are the ways from sending color TV, and they do not have anything to do with the standards for black & white TV, which also vary from country to country. For analog radio, the switch to digital radio is made more difficult by the fact that analog receivers are sold at a small fraction of the price of digital receivers. The choice of modulation for analog radio is typically between amplitude modulation (AM) or frequency modulation (FM). To achieve stereo playback, an amplitude modulated subcarrier is used for stereo FM.

(adopted from http://en.wikipedia.org/wiki/Telecommunication#Radio_and_television)

D. Vocabulary

Match part 'A' and part 'B'. Write down a letter in part A to the bracket in part B.

Passage 1:

Part A

A. Transmission
B. Semaphore
C. Heliograph
D. Beacon
E. Microwave communications
F. Teletype

Part B

1. A system of conveying information by means of visual signals such as flags. ( )
2. A wireless solar telegraph that signals using Morse code flashes of sunlight reflected by a mirror. ( )
3. The process of sending, propagating and receiving an analogue or digital information signal over a physical point-to-point or point-to-multipoint transmission medium. ( )
4. It is a now largely obsolete electromechanical typewriter that can be used to communicate typed messages from point to point and point to multipoint over a variety of communications channels. ( )
5. An intentionally conspicuous device designed to attract attention to a specific location. ( )
6. It refers to the technology of transmitting information by the use of the radio waves whose wavelengths are conveniently measured in small numbers of centimeters, by using various electronic technologies. ( )

Passage 2:

Part A

A. Electrical telegraph
B. Electronic amplifier

Part B

1. A device for increasing the power of a signal. ( )
2. A telegraph that uses electrical signals. ()

Passage 3:

Part A

A. W-CDMA (Wideband Code Division Multiple Access)
B. GSM (Global System for Mobile Communications)
C. Asynchronous Transfer Mode (ATM)
D. Traffic contract
E. Multiprotocol Label Switching (MPLS)
D. Multiplexing
E. Telephone exchange
F. Fixed-line

Part B

1. It refers to a telephone line which travels through a solid medium, either metal wire or optical fibre. ( )
2. It is a system of electronic components that connects telephone calls, also called telephone switch. ( )
3. Originally from *Groupe Spécial Mobile,* it is the most popular standard for mobile telephony systems in the world. ( )
4. It is an air interface standard found in 3G mobile telecommunications networks. ( )
5. It is a standardized digital data transmission technology. It is implemented as a network protocol and was first developed in the mid 1980s. ( )
6. It is a process where multiple analog message signals or digital data streams are combined into one signal over a shared medium. ( )
7. If a service (or application) wishes to use a broadband network to transport a particular kind of traffic, it must first inform the network about what kind of traffic is to be transported, and the performance requirements of that traffic. ()
8. It is a mechanism in high-performance telecommunications networks which directs and carries data from one network node to the next. ( )

Passage 4

Part A

A. Modulation
B. Demodulation
C. Integrated circuit
D. Amplitude modulation (AM)
E. Frequency modulation (FM)

Part B

1. It is a miniaturized electronic circuit (consisting mainly of semiconductor devices, as well as passive components) that has been manufactured in the surface of a thin substrate of semiconductor material. ( )
2. It is a technique used in electronic communication, most commonly for transmitting information via a radio carrier wave. It works by varying the strength of the transmitted signal in relation to the information being sent. ( )
3. It conveys information over a carrier wave by varying its frequency. ( )
4. It is the process of conveying a message signal, for example a digital bit stream or an analog audio signal, inside another signal that can be physically transmitted. ( )
5. It is the act of extracting the original information-bearing signal from a modulated carrier wave. ( )

E. Expansion

Make a group of five. Discuss the following topic:

"What are the negative effects of television programs for kids and how to avoid those negative effects."

After discussing, present your opinion.

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The Comparison of Experimental and Analytical Study of the Gaussian IntensityDistribution for Light Emitting Diodes Beam

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Abstract: Problem statement: Wireless communication using white Light Emitting Diodes (LEDs) is the latest research field for next-generation communication. This study studies the comparison of Gaussian intensity distribution of the white LED using experimental and analytical method. The white LEDs are conducted to transmit an audio signal to the receiver. The receiver circuit consist of solar cell connected to the speaker to recover the audio signal. From the comparison of experimental and analytical data, the Gaussian plot of experimental data is steeper than the analytical data, meaning that the LED has small-divergence beam. **Conclusion/Recommendations:** The output voltage of experimental works decrease exponentially with the distance whiles the Full Width Half Maximum (FWHM) value increase exponentially with the distance. The gradual increment and decrement of the analytical signal can be applicable to visible light communication implementation as such light source can cover wide area for signal transmission.

Key words: Wireless communication, white LED, solar cell, visible light, Gaussian intensity distribution, Full Width Half Maximum (FWHM)

INTRODUCTION

Lighting industries the world over are moving forward with the production of white Light Emitting Diodes (LEDs) for illumination, replacing fluorescent and incandescent bulbs. The white LED is expected to be the next-generation lighting source because of its numerous advantages over other technologies. Compared with conventional lighting devices, white LEDs exhibit low power consumption, long life expectancy, high reliability, small size and high tolerance to humidity. Compared with normal lights, another important property of LEDs is their ability to be modulated at high speeds. This ability makes it possible for LEDs to be used as signal transmitters. It is useful for short-range communication systems that could be implemented in indoor and outdoor applications (Tanaka *et al*., 2000; Komine and Nakagawa, 2004; Tanaka *et al*., 2003), which are currently dominated by Radio Frequency (RF) communication.

The ability of LEDs to be signal transmitters means that LEDs could act as dual-function devices for both lighting and communication. Wireless communication that relies on light is known as "Visible Light Communication". The visible light spectrum offers unlimited bandwidth and is unregulated worldwide. Using visible light for indoor communication is secure from eavesdropping, because visible light cannot penetrate walls or other opaque barriers. Signal transmission is confined to the room in which the signals originate and interference between links operating in different rooms is thus prevented.

The use of RF for communications is restricted in specific areas, such as hospitals and on flights, because of the effect of interference on precision equipment. This study presents a basic experiment that demonstrates audio transmission using a white LED. Currently, short-range audio transmission can be accomplished using the RF technology known as Bluetooth. This study discusses basic experimental work that was carried out to demonstrate the use of LED beams to realise wireless communication. The success of this experiment is an indicator that future-generation communication systems will no longer rely on RF but will instead utilise visible light.

Overview:

Infrared Vs visible light communication: As explained by (Khan and Barry, 1997), both visible and infrared light offer unlimited bandwidth and high-speed

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transmission. Some characteristics of LEDs and Laser Diodes (LDs) are quite similar, but there are still differences between the electromagnetic waves the two types of diodes produce. The major difference is that the optical output of the LED is incoherent, while that of the LD is coherent (Keiser, 2008). Moreover, infrared radiation can present human eye safety hazards, because it can pass through the human cornea and be focussed by the lens onto the retina, where it can potentially induce thermal damage (Rancourt, 1993). This means that visible light has more potential for use in indoor short-range communication because it is not harmful to humans.

The progress of visible light communication: Keiser (2008) began his study by noting the rapid spread of research and development of visible light communication (Nakagawa, 2007; Langer *et al*., 2008; 2009; Conti, 2008), as well as the growth of the worldwide LED illumination market. In this study, he proposed a new photodetection technique using image processing instead of PIN-photo diodes or avalanche photo diodes (Keiser, 2008). According to (Keiser, 2008), using a high-speed sensor with a frame rate of thousands of frames per second enables data rates on the order of kilobits per second (Keiser, 2008). An indoor optical wireless duplex communication system was introduced by (Rui *et al*., 2009), who proposes a system using white LEDs as the emitters in the downlink and infrared LEDs in the uplink. Through experiments in a prototype room, they discovered that the LED emission properties, the positions of multiple light sources and path differences in diffuse channels were the three main factors influencing the pulse response.

Gaussian LED beams: The Full Width Half Maximum (FWHM) describes the measured width of the Gaussian graph, as shown in Fig. 1. The w stands for the beam waist and the FWHM is equal to w times 2. Figure 2 shows the characteristic of an LED beam that produces incoherent optical output. The incoherent source has a broad spectral width because the optical energy is emitted into a hemisphere according to a cosine power distribution (Keiser, 2008). Therefore, the LED beam will propagate with a large divergence. The large divergence of the beam makes LEDs appropriate for illuminating wide areas for human activity. The Gaussian profile indicates that the strength of the beam-like wave falls off in the transverse direction according to a bell-shaped curve that is symmetrical around the central axis, illustrated in Fig. 1 (Hecht, 2008). A Gaussian function of a variable is the negative exponential of the square of that variable, which in this case is the distance (r) in a transverse plane from the central axis of propagation (z) (Hecht, 2008).

Experimental work:

Transmitter and receiver circuit: In wireless communication systems, there are only two components that influence the output efficiency of the signal: the transmitter and the receiver. In an optical communication system, the output signal produced at the receiver must be the same as the input signal being transmitted.

Figure 3 is a block diagram of the entire optical audio transmission system. The audio signal is encoded by the encoder and injected to the current amplifier and the LED driver. The LED driver is then connected to the LED and the signal is transmitted using the LED's light spectrum. The light propagates to the photodetector, which acts as the receiver. At the receiver, the signal passes through a filter to filter the noise. Next, the signal is amplified and decoded back to an analogue signal. Finally, the amplified signal is connected to the speaker. A comparator is used to calculate the speed of the link between the transmitter and the receiver.

The circuit shown in Fig. 4 was constructed and tested in the laboratory and some of its characteristics were analyzed. The basic circuit used a super-bright LED as the modulator. This transmitter works by modulating the amplitude of the light based on the amplitude of the audio signal being transmitted. The receiver was built using a solar cell and a speaker was connected to it.

A standard 3.5 mm audio jack feeds the audio signal to the circuit, which is sent to the 470-ohm resistor, a switch and a 9-volt battery. The battery provides a steady DC current to the LED and causes it to glow with a fixed brightness. The resistor's function is to limit the current so the LED does not burn out, whereas the switch is used to control the circuit.

A weak, fluctuating radio signal is added to the constant signal from the battery after the audio jack is connected to the audio source. The LED still glows, but now it blinks synchronously with the audio signal as the current passing through it varies. Electrical signals are generated when the blinking light hits the solar cell. This signal again varies in synchronisation with the original audio signal. The signals are then fed to the speaker, recreating the original sounds from the audio source.

The experimental setups are shown in Fig. 5-8 show photographs of the actual setups taken during the experiments.

The value of the output voltage according to the position of light on the receiver is recorded for analysis. By varying the vertical position X and the horizontal position Y, the effectiveness of the photocell and the relationship between the position and the induced voltage can be studied. The receiver is connected to the amplified speaker and a multimeter. Observations are made based on the data collected and the output audio signal heard.

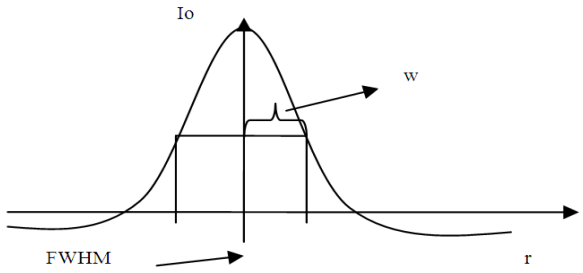

Fig. 1: Gaussian beam-like wave propagation

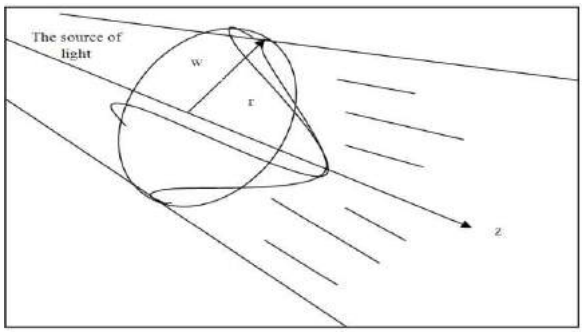

Fig. 2: The light beam produced by an LED propagating through air

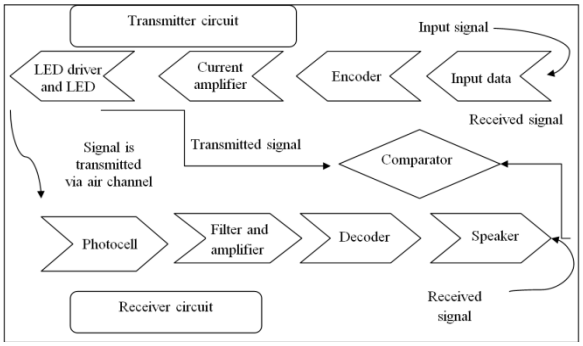

Fig. 3: A diagram of the transmitter and receiver of a visible light communication system

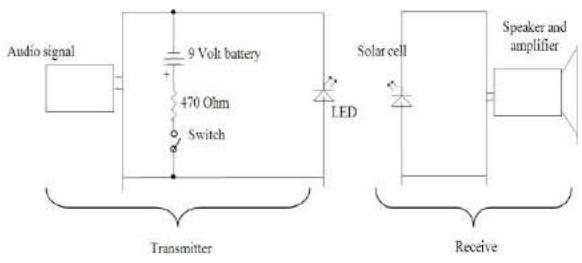

Fig. 4: Circuit used to carry out the experiments in the laboratory.

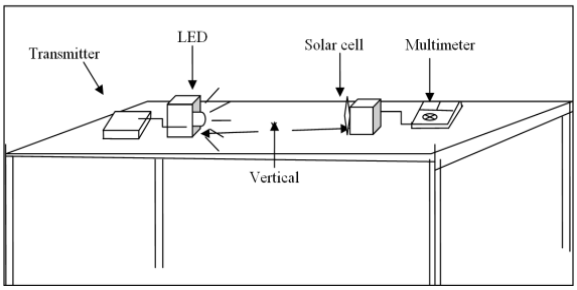

Fig. 5: Experimental setup to measure the relationship between the vertical distance X and the output voltage

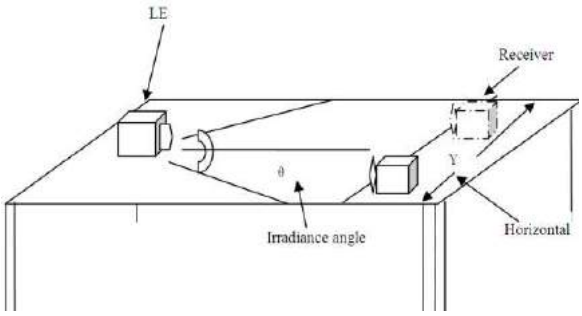

Fig. 6: Experimental setup to measure the relationship between the horizontal distance, Y and the received voltage

Fig.7: The LED shines directly on the photocell

Fig. 8: A photo taken of the experimental setup of Fig. 6

The results: The basic circuit in Fig. 4 was tested by measuring the output voltage while varying 2 parameters: the horizontal distance Y and the vertical distance X. The setups are shown in Fig. 5 and 6. Eq. 1, shown below, was used to calculate the analytical value of the output voltage in the form of an electric field (Es). The experimental and analytical results were compared and analyzed (Hecht, 2008):

$$Es = Eo \times e(r^2/w^2) \quad (1)$$

R refers to the distance between the transmitter and the receiver, while w represents the width of the LED spectrum. Let r = w be the beam's half-width, the distance at which the electric field of the beam drops from its maximum axial value Eo to 37% of Eo (Hecht, 2008). In the graph below, the Y position is negative so that the Gaussian distribution is evident in the graph of the output voltage. The centre of the receiver is at the value of Y = 0 and the plots extend 6 cm to the left and right.

From Eq. 1, the intensity can be calculated using a second Eq. 2 (Hecht, 2008):

$$Is = \eta \times Eo \times Eoe^{-}\left(\frac{2^{-2}}{w^2}\right) \quad (2)$$

The electric field is measured in units of voltage and compared with the experimental result, as explained in the observation and discussion sections. The second observation is the output audio signal, which could be heard as the distance varied.

Graphs of observations: The graphs in Fig. 9, labelled a-g, present a number of observations. These observations demonstrate that the vertical distance X (Fig. 5) and the horizontal distance Y (Fig. 6) affect the output voltage value. Data were measured in 2 experimental setups, one in which the X position was varied and the Y position was fixed and another in which the Y position was varied and the X position was fixed, as shown in Fig. 5 and 6. Instead of observing the output voltage as a function of these distances, the output audio signal could also be observed. The Gaussian intensity distribution graphs in Fig. 9a-g show the observed and analytical distributions of light as the horizontal distance Y was varied at a fixed vertical distance, as shown in Fig. 6.

The results show that the highest value of the output voltage, 0.175 V, was obtained at a vertical distance X of 5 cm and a horizontal distance Y of 0 (at the centre), as shown in Fig. 9a. At this peak point, the output audio sound was clear. The comparison in Fig. 9a reveals a slight difference in the peak experimental and analytical values. The experimental result also deviated significantly from the analytical result as the output voltage was very sensitive to changes in position. In other words, the observations revealed much steeper increments and decrements than the analytical result. The output sound could be recovered from the speaker up to Y distances of 6 cm to the left and right, but the quality of the signal was low.

Figure 9b shows a comparison of the experimental and analytical outputs at a vertical distance X of 10 cm. The difference of the peak output voltages of the two graphs is 10 mV. The graph of the experimental data increases and decreases more drastically than the analytical graph. The highest output voltage was obtained at a horizontal distance Y of 0 cm (at the centre). At this point, the output sound could be heard clearly. The experimental setup seems to be very sensitive to the changes in the horizontal position. At a vertical distance of X = 10 cm, the sound could be heard out to Y positions 6 cm to the left and right, but the sound was unclear and of low quality.

In Fig. 9c, the distance between the transmitter and receiver was increased to X = 15 cm. The received output voltage and the quality of the output audio signal were lower than at X values of 5 and 10 cm, shown in Fig. 9a and b, respectively. The difference between the analytical and experimental peak output voltages is 31 mV. The experimental graph increases and decreases significantly as the horizontal distance Y varies 6 cm to the left and to the right and the intensity of light received at the photodetector at the maximum Y distances (-6 and 6 cm) is very low. The output audio sound could only be heard out to Y positions 4 cm from the centre.

In Fig. 9d, the vertical distance X is fixed at 20 cm. The difference in the analytical and experimental peak voltages is 37 mV, which is larger than those shown in Fig. 9a-c. As before, the graph of the analytical data increases and decreases gradually, whereas the experimental graph increases and decreases sharply. The value of the experimental data at the maximum horizontal distances -6 and 6 cm is zero, while the analytical value is 29 mV at the same Y positions. A voltage of zero means that the receiver did not receive any light and the receiver produced no output audio. The audio signal could still be heard at Y = 0 cm, but the quality was lower than it was in the setups of Fig. 9a-c.

Figure 9e shows the analytical and experimental results at a distance of X = 25 cm. The analytical graph increases and decreases gently as the horizontal position varies, but the experimental graph is again steeper and the difference in the peak output voltages is 35 mV. The experimental peak value is 60 mV at the position Y = 0. The output audio signal produced by the receiver could be heard until the Y position reached 4 cm from the centre.

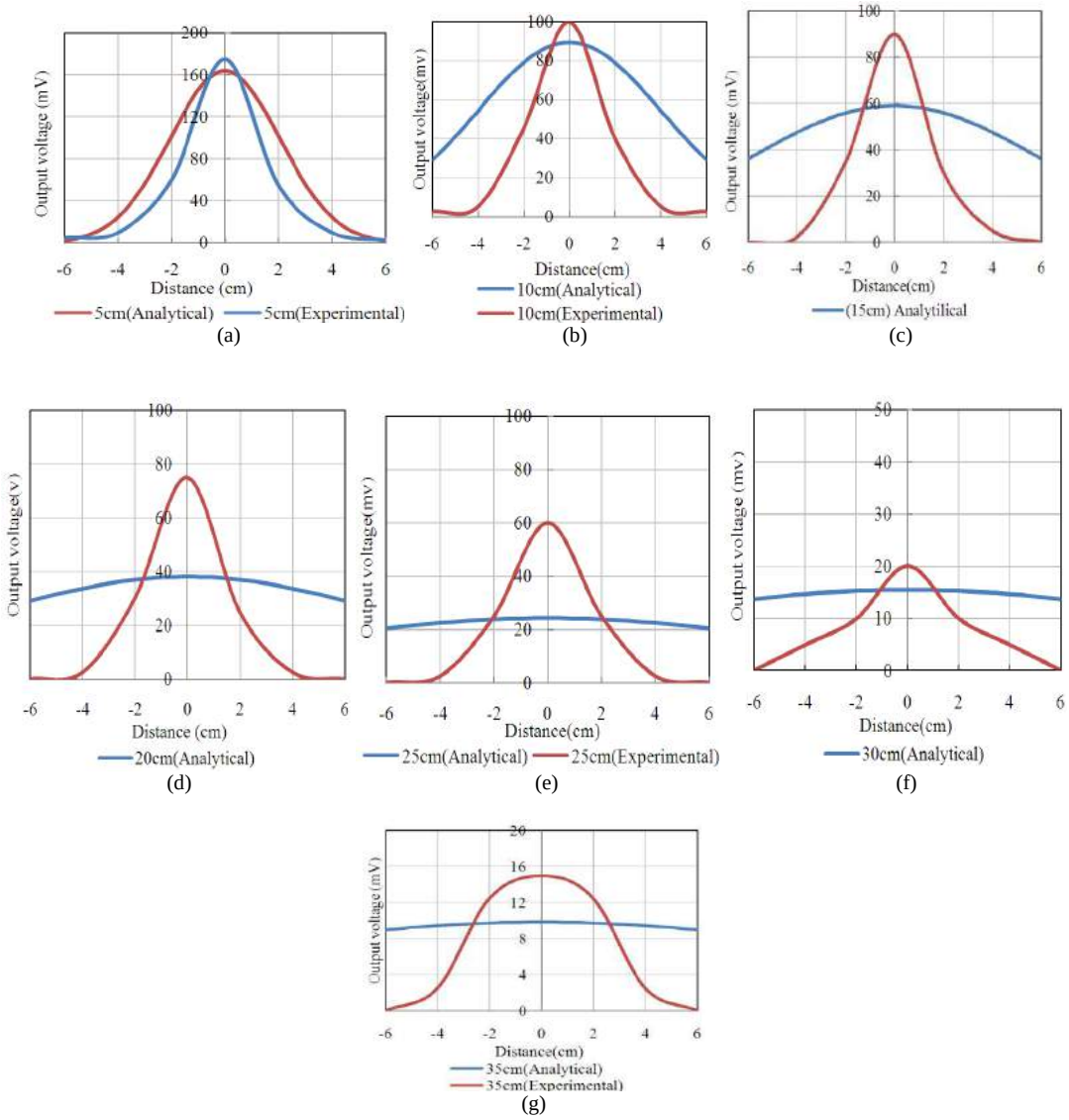

Fig. 9: Comparison between the experimental and analytical graphs. At a distance of (a) X = 5 cm, (b) X = 10 cm, (c) X = 15 cm, (d) X = 20 cm, (e) X = 25 cm, (f) X = 30 cm and (g) X = 35 cm

In Figure 9f, the difference between the analytical and experimental peak output voltages was small. At the distance X = 30 cm, the experimental graph increases gradually until Y positions approximately 2 cm from the centre and the graph becomes steeper near the peak. The decrement also follows the same trend: steep for the first 2 cm and more gradual as the distance increases. The difference between the peak voltages is only 5 mV. The sound quality produced by the speaker was low.

In Fig. 9g, at an X distance of 35 cm, the increment and decrement of the experimental graph again becomes more gradual. The intensity of light received by the photocell was quite weak at this point and this can be seen in the resulting output voltage. The quality of the output audio signal was the lowest at this X distance. The audio signal could only be heard until Y positions 2 cm to the left and right of the centre. The analytical data again exhibits a gradual increment and decrement, as shown in Fig. 9b-f. Figure 10 shows the output voltage at Y = 0 as X varies from 5-35 cm. The graph shows that the intensity decreases exponentially with the X distance. The data is plotted with the exponential model function of below Eq. 3:

$$y = \alpha \times e^{bx} + c \quad (3)$$

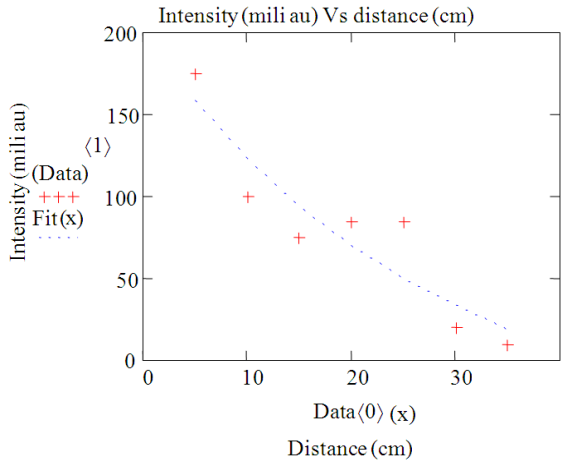

Fig. 10: The exponential shape of the output voltage at a fixed Y value (Y = 0, at the centre) as the vertical distance X varies from 5-35 cm

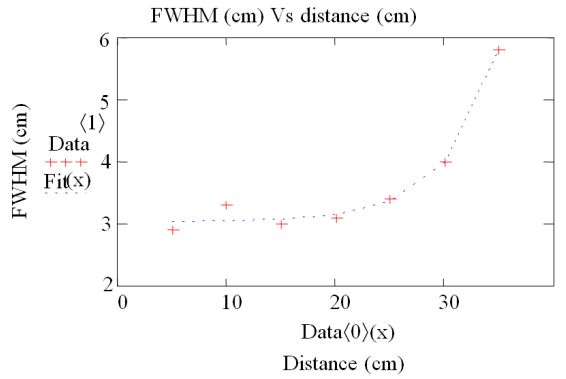

Fig. 11: An exponential graph of the FWHM versus the vertical distance X

where, a, b and c is the coefficients of the graph. As the distance becomes large, the received output voltage becomes small. The received output voltage depends on the intensity of the light falling on the surface of the photodetector. The graph above come across of an Eq. 4 below:

$$y = 248.415 \times e^{-0.027x} - 47.25 \quad (4)$$

The equation relates that the initial value of intensity at the distance of 0 is approximately y = 248.415-47.25 that gives the value 2.011mili au. This graph is plotted in the MathCad software and, the value of coefficients a is 248.415, b is -0.037 and c is -47.25.

Figure 11 shows the full width at half maximum versus the vertical distance X. Generally, the full width at half maximum increased proportionally with the X distance. The data plotted in Fig. 11 shows that the relationship between FWHM and X is exponential and the model function is expressed. The equation that extracted from the Fig. 11 is as below Eq. 5:

$$y = 1.718.10^{-3} \times e^{0.211x} - 3.037 \quad (5)$$

It means that at the distance of 0, the value of FWHM is approximately 3.039 cm. Applying the same model faction and same program of the graph in Fig. 10, the FWHM increased exponentially with the value of coefficients a, b and c are 0.00718, 0.211 and 3.037.

The graphs in Fig. 9b-g show that the experimental peak output voltage is higher than the analytical peak voltage because of the profile of the LED. Different LED profiles produce different results. Brighter LEDs will produce very high peak intensities on the photocell. The experimental voltage is a steeper function of the horizontal distance Y than the analytical voltage. The sensitivity to received light is related to the light beam produced by the LED and will decrease when the transmitted beam is wide. A wider light beam will allow the receiver to receive light at distances beyond 6 cm from the centre. The experimental results plotted in Fig. 9a-g exhibited Gaussian intensity distributions. Figure 10 revealed that the light intensity is reciprocal to the distance between the transmitter and receiver. The output audio signal could still be heard at a distance of X = 35 cm, but only at horizontal distances up to 2 cm from the centre as the received intensity decreased when the distance increased. The sound could still be heard until a distance of 50 cm if the transmitter and receiver were directly facing each other (Syuhaimi and Ab-Rahman, 2011).

The exponentially decrement of intensity of light versus the distance proving the theory of light that, as the source far apart from the receiver, the intensity become low. In Fig. 11, the full width at half maximum distribution explained the characteristics of the LED light used in this study. As the distance varied, the radius of the LED light became larger, because the LED beam diverges as it propagates (Keiser, 2008).

CONCLUSION

From the observations and the discussion of the graphs, we conclude that wide beams are needed in visible light communication systems to ensure that the light is able to brighten a wide area with high intensity. A wide, high-intensity beam will ensure that the transmitted signal can be received by a photodetector at any point in the illuminated area. The analytical graphs in Fig. 9 are more applicable than are the experimental

graphs because they represent a beam with a large divergence. Moreover, large-divergence and high-intensity beams will influence the values of the full width at half maximum shown in Fig. 11. The Full Width at Half Maximum (FWHM) represents the diameter of the LED beam. Figure 11 shows that the LED beam diverges strongly as it propagates because as the distance increased, the value of the FWHM also increased. A specific LED profile with high intensity and a broad beam should be used in visible light communication applications. In fact, the method of data collection in the experiment seems to be effective, as the experimental peak output voltage is generally higher than the analytical expectation at the point Y = 0 cm (at the centre). The experimental results were influenced by the perpendicular position of the transmitter and the receiver. The large difference in the peak output voltages could also have been caused by external factors, such as the reflection of light from the table surface to the receiver, which would cause the intensity to be higher than expected. The experimental peak voltages shown in Fig. 10 reveal that the output voltage, which is proportional to the light intensity decreased exponentially with the changes of the distance.

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Wavelength Division Multiplexing Network over Polymer Optical Fiber using Fabricated Couplers for Informatics Communications

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Abstract

The implementation of three channels wavelength division multiplexing (WDM) network using a low cost and all POF components are developed. A low cost and high performance of 1x3 POF fused coupler/splitter using POF polymethyl methacrylate (PMMA) is fabricated as the multiplexer/de-multiplexer. Three visible LED light source transmitters; 470 nm, 520 nm and 650 nm are utilized in sending three data inputs; the CCTV and DVD video and audio signal. The optical lights are multiplexed into a single POF link and de-multiplexed back at the receiver end. The unwanted wavelengths are performed using thin color film filter before the receivers. With link margin 5 dB, the maximum POF link length is 25 meters which is suitable for informatics, infotainments, triple play in the field of last miles communications.

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Keywords: Wavelength division multiplexing; polymer optical communication; fused coupler; last mile optical communications;

1. Introduction

Technology advances has exploded the development of POF as an alternative mediums for data and informatics communications such as computer applications, security and surveillance systems, automobile networks, industrial automations and residential networks and infotainments. These is due to an increasing demand for high-rate

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communication in the consumer's premises and office areas to provide services like fast internet access, compressed digital video based service (MPEG) and infotainment. The transmission media used at present are not suitable for provisioning high-bandwidth services at low cost. For instance, today's wiring in local area networks and home entertainments applications is based mainly on copper cables (twisted-pair or coaxial) and glass fiber GOF. Copper based technologies suffer strong susceptibility to electromagnetic interferences and have a limited capacity for digital transmission. Conventional silica based fibers are costly solution because they requires precise connecting and dedicated installation and handling. In order to increase the capacity of transmission and allow bidirectional communication over one strand fiber, wavelength division multiplexing (WDM) in POF technology is used. This technique multiplexed multiple optical carrier signals on a single optical fiber using different wavelength (colors) of the light source to encode different signals.

POFs are low cost, easy connection and high numerical aperture compared to glass fiber [1]. POF with PMMA resin core and fluorinated polymer cladding materials has a lower refractive index and a large diameter of 1 mm with a drawback of high attenuation due to high mode dispersion. POF is more efficiently used for short distance last mile data communication up to 200 m.

Figure 1 (a) shows the structure and its size compared to glass fiber. The attenuation behavior of POF in the visible light ranges 400 nm to 700 nm taken from data sheet of Eska Mitsubishi Rayon for PMMA step index POF product is translated in Figure 1 (b). Visible LED light source is a better choice for its high reliability, less temperature dependency, simple drive circuitry (no threshold) and low cost [2]. This light source consumes low power and support the green technology.

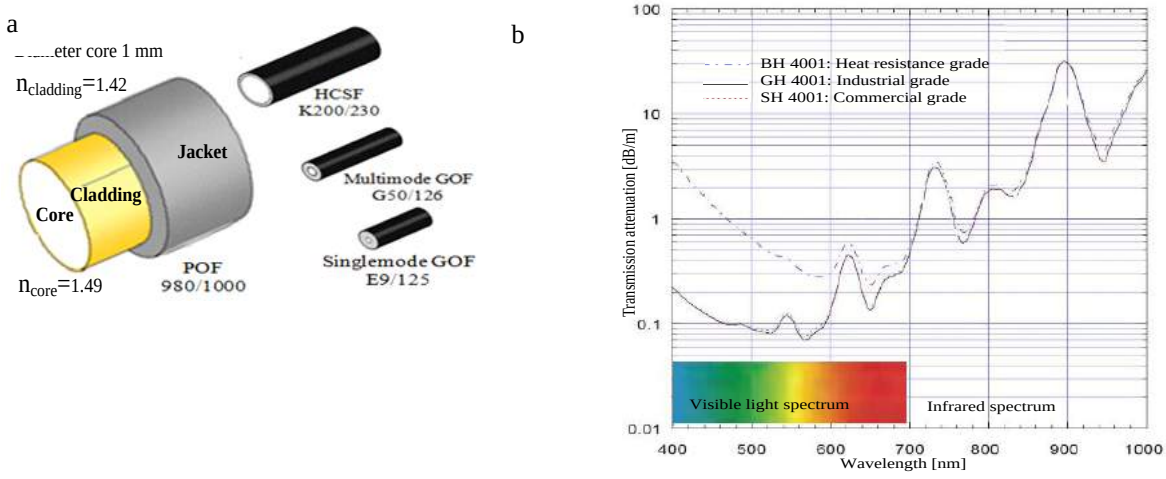

Fig. 1. The characteristics of PMMA-POF. (a) The structure and size compare to glass fiber; (b) The attenuation at various visible light wavelength spectrums.

POF is also easy to handle and simpler to design a connector compared to glass fiber. Furthermore, POF is also easy to be used for fabricating passive devices such as coupler and splitter. The fabricated coupler and splitter are also used to multiplex and de-multiplex optic light to realize the wavelength division multiplexing (WDM) network [3].

2. Fabrication of Fused Coupler

Basic requirement in realizing a WDM-POF network is by using all POF passive components includes transmitter, POF cable link, connectors, multiplexers, de-multiplexers and receiver. The multiplexers and de-multiplexers are made using self-fabricated couplers with fused tapered technique with a PMMA POF cable cord

as the main materials [4].

The step-by-step fabrication process for the 1x3 fused tapered coupler are as follows; first, three bared POF cords of 23 cm each are arranged closely to form a bundle and inserted into a metal tube. The POF fiber bundle is indirectly fused by uniformly heating up the metal tube along the length using hot air gun blower. When the temperature inside the metal tube approaches the thermal deformation of the PMMA (at about 90 ^{0}C), the POF bundle is repeatedly twisted and fractionally pulled. The twisting and pulling procedure is performed continuously until several turns are formed to produce about 1 cm length of twisted spiral at the center of the POF fiber bundle. When the POF fiber reaches its melting point, the fiber bundle is pulled stronger without any twist until the diameter of the fused tapered area decreases to ~ 1 mm. The length of the tapered fused area is limited to approximately 2 cm. At the end of the process, the center of the fused taper bundle splitter is cut using a POF hot knife cutter. Then, the single input is inserted into a 1 mm DNP connector and three output ports are inserted into the POF connection locking in the coupler casing. Figure 2(a) shows the fabricated coupler is placed inside the casing and Figure 2(b) shows the final product of the 1x3 fused tapered coupler fabricated using the PMMA POF.

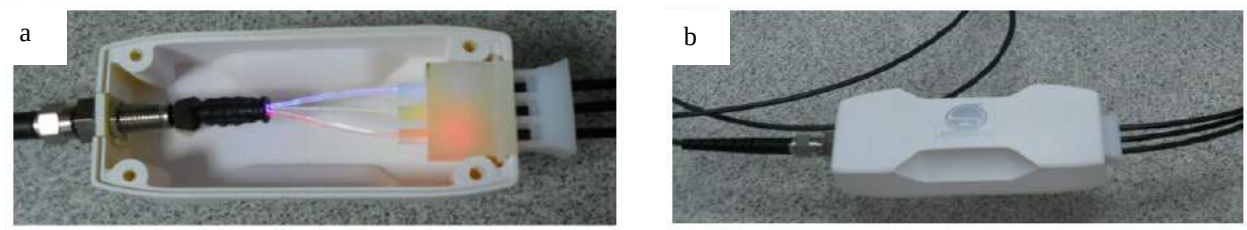

Fig. 2. The arrangement of fabricated POF fused tapered coupler casing. (a) 3x1 coupler placed inside the casing,;(b) Final product 3x1 coupler.

3. Couplers Performance and Analysis

The performance of the fused tapered couplers is evaluated in terms of insertion loss, excess loss, cross-talk and splitting ratio. Insertion loss (L_i) is the ratio of the optical power launched at the input port of the coupler to the optical power from any single output port, expressed in dB. The insertion loss for output port *n* is expressed as,

$$L_i \text{ (dB)} = 10 \text{ Log } (P_{out\ n} / P_{in}) \quad (1)$$

The power output is measured between input port and all outputs port using optical power meter for all 10 couplers fabricated to investigate the insertion loss. Figure 3 shows the measured insertion loss. The average insertion loss is measured 6.6 dB representing the average of 6.4 dB, 7.5 dB and 5.9 dB power measurement for port 1, 2 and 3 respectively.

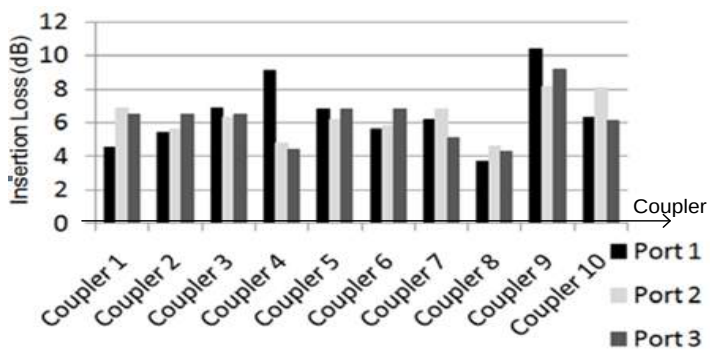

Fig. 3. Insertion loss measured in random among 10 fused couplers fabricated.

Excess loss (L_e) is the ratio of the optical power launched at the input port of the coupler to the total optical power measured from all output ports, expressed in dB. It is defined as the ratio of power input to power output and is given by,

$$L_e\ (dB) = 10 \log (P_{out}/P_{in}) \quad (2)$$

Where, $P_{out} = P_1 + P_2 + P_3$ (3)

And P_{in} is power input, P_{out} is power output total, P_1 is power of port 1, P_2 is power of port 2 and P_3 is power at port 3.

The excess loss for the 10 coupler fabricated is plotted in Figure 4. The average access loss is measured acceptably 1.8 dB.

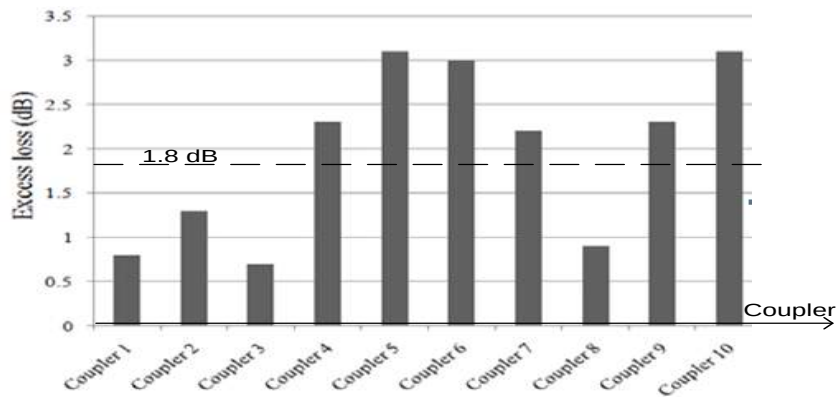

Fig. 4. Excess loss measurement for 10 numbers of fused couplers fabricated.

The splitting ratio measurement is performed by measuring the output power at each output terminals. The splitting ratio of fabricated 1x3 couplers is measured at average of 1/3 ratio, substantiate that this coupler is a good optical power combiner/splitter. Due to the perfection of the twisting and fusing effect during the fabrication, the splitting ratio is varies unevenly as expected. Figure 5 shows the measured percentages of the splitting ratio of the fabricated couplers. From this result, we now can choose the required coupler to suit the best multiplexer and de-multiplexer that suitable for specific transmitter based of its output power.

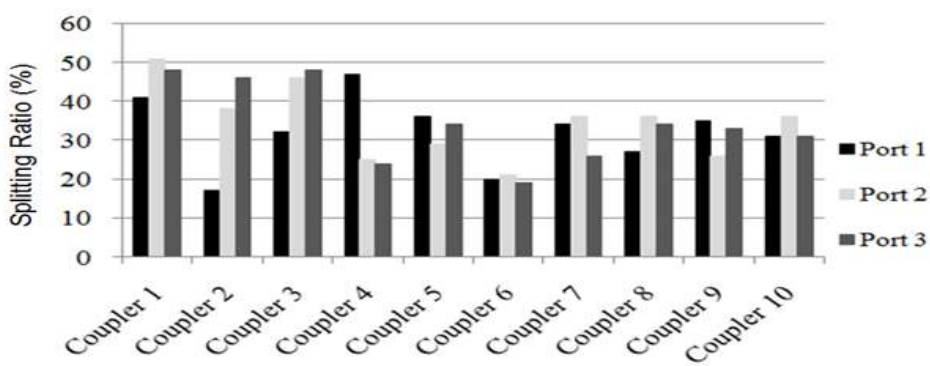

Fig. 5. Splitting ratio measured among 10 fabricated fused couplers.

In realizing an all WDM-POF network technology, the components used in the network are fabricated using PMMA materials and the light sources are LEDs. WDM-POF is a technology where a multiple LED visible optical signals are multiplexed into a single POF link using a multiplexer in this case, the fabricated low cost fused coupler. This technique is also enables bidirectional communications over one POF possible, thus will tremendously multiply the link bandwidth capacity.

Figure 6 shows the illustrative diagram of the three channels WDM-POF network used in this experiment set-up. In this experiment, we utilize analog transmissions over POF from two devices, the DVD player and the CCTV camera. The devices input electrical signals are modulated and converted into specific colored LED light signals in the transmitters. The DVD video signals is converted into red light signals transmitting at wavelength 650 nm and the CCTV signals are converted into blue light signals transmitting at 470 nm and green light signals transmitting at 520 nm.

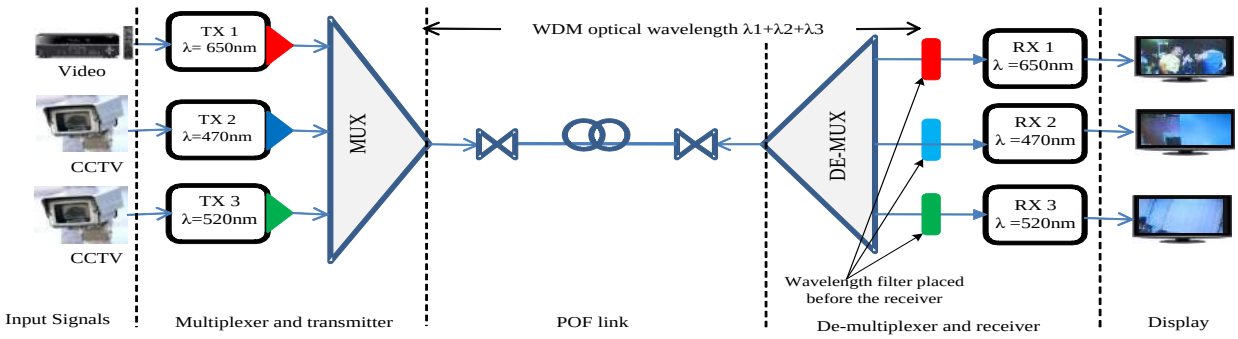

Fig.6. Basic set-up for 3 channel WDM-POF network.

Figure 7 shows the laboratory experimental layout where three inputs from two CCTVs and one DVD signals are multiplexed into a 25 meters POF link using three wavelength transmitter experimental module.

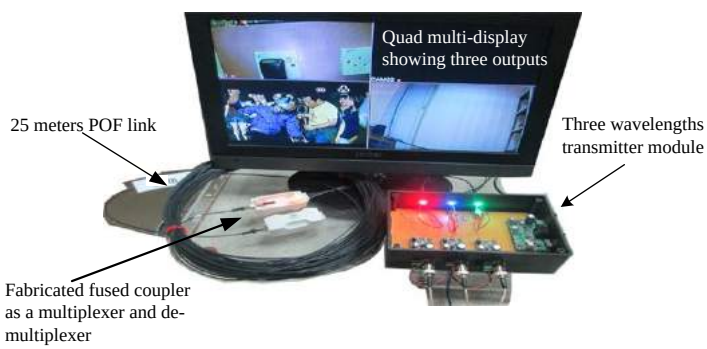

Fig.7. Experimental layout set-up for WDM-POF three channel visible light spectrum blue 470 nm, green 520 nm and red 650 nm.

The other important process in realizing WDM-POF network is de-multiplexing the multiplexed light signals. Among the technique used is prism-spectrometer. The optical phase array technique is still under development and not widely available in the market. In this paper we use a simple thin film color filter technique using Roscolux color filter that available in the market [5]. By choosing a correct filter based on the spectral energy distribution curve provided by the manufacturer, we measure the output light spectrum and the output power after the light filtration. The aim is to remove unwanted light spectrum that carry optical signals in order to prevent crosstalk at the receiver. We used #385 royal blue filter film for blue 470 nm wavelength, #389 chroma green for green 520 nm wavelength and #19 fire red for red 660 nm wavelength spectrum. The thin film is firmly attached at the receiver connector without gluing with epoxy-resin, thus reducing the optical power loss in the connector. The wavelength spectrum is sampled after the filter and the result are shown in Figure 8 measured using Ocean Optics Spectrometer. Figure 8 (a) shows output of WDM optical lights spectrum from the multiplexer. The intensity count

of each wavelength is depending to the LED intensity count and hence the optical power. Figure 8 (b) shows the spectral optics from the POF just before the receiver for green 470 nm wavelength. The chroma green thin film filter has successfully filtered the blue 470 nm and red 650 nm. In Figure 8 (c) the royal blue thin film filter is used to filter green 470 nm and red 650 nm and allow blue 520 nm passing the filter to the receiver. Figure 8 (d) shows thin film fire red is used to filter the blue 470 nm and green 520 nm and allow red 650 nm to the receiver. The spectral wavelength shows in Figure 8 (b), (c) and (d) shows there is no cross-talk and noise at the receiver as the unwanted spectral wavelength was successfully filtered.

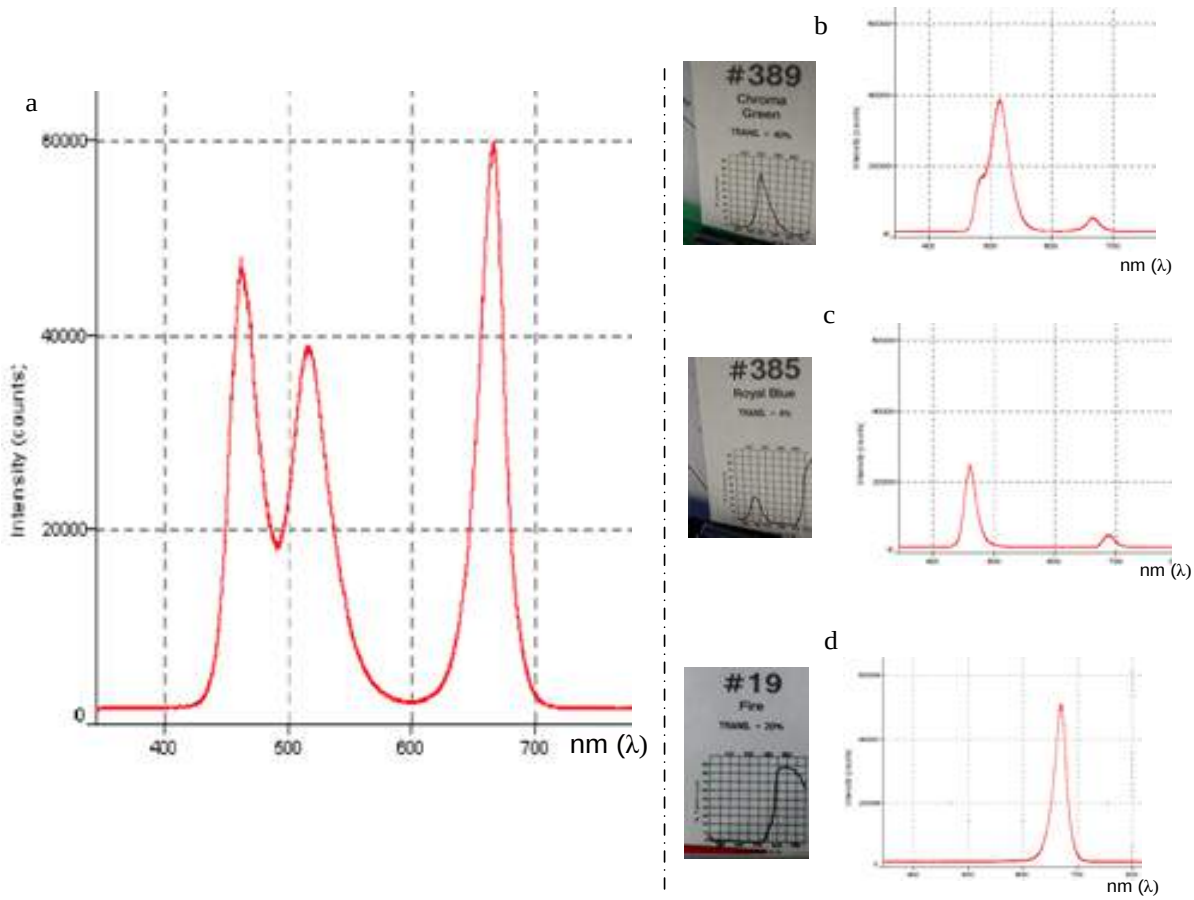

Fig. 8. Visible light spectrum measured using Ocean Optics Spectrometer at various point in the WDM-POF network experiment set-up. (a) WDM visible light spectrum of blue 470 nm, green 520 nm and red 650 nm measured from multiplexer output. (b) Optical light spectrum output at termination before the input to the receiver of green 520 nm wavelength after passes chroma green WDM filter. (c) Optical light spectrum after passes royal blue WDM filter. (d) Lights spectrum after passing fire red filter.

3. Result and Discussion

The LED visible light wavelength spectrum of 470 nm, 520 nm and 650 nm were multiplexed and wired through the POF cable link to the de-multiplexer. At the connectors before connected to the receivers input, selected thin color film is placed firmly and the unwanted multiplexed light wavelength spectrums are filtered out.

This filtered optical signal is converted into electrical signals at the receivers and displayed on the LCD TV screen for viewing. With the link margin of 5 dB, and maximum power at the receiver of 32 dBm, we experience maximum distance of 25 m POF link for these 3 channels WDM using fabricated 1x3 fused coupler.

4. Conclusion

We have presented the fabrication of a low cost and high performance of 1x3 POF fused coupler/splitter using POF polymethyl methacrylate (PMMA). The coupler average insertion loss is measured 6.6 dB representing the average of 6.4 dB, 7.5 dB and 5.9 dB for port 1, 2, and 3 respectively. The average excess loss of the couplers was acceptably 1.8 dB. These couplers were used as multiplexer and de-multiplexer in a three channels WDM-POF network. Three visible LED light source transmitters; 470 nm, 520 nm and 650 nm were utilized in sending three data inputs; CCTV and DVD video and audio signal. The optical lights were multiplexed into a single POF link and de-multiplexed back at the receiver end. The unwanted wavelengths were rejected using thin colour film filter before the receivers. With link margin 5 dB, the maximum POF link length is 25 meters which is suitable for informatics, infotainments and triple play in the field of last miles communications. This technique and low cost WDM-POF network is a potential solution compared to the traditional coaxial and copper based cable in many areas of short distance communications in the near future.

Acknowledgements

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Simple design flow injection PMMA acrylic sample cell for nitrite determination

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A polymethyl-methacrylate (PMMA) acrylic sample cell using flow injection is developed in this research for the determination of nitrite in an aqueous media. The research focuses on exhibiting direct absorbance spectrophotometry of nitrite using concentration of samples ranging from 0.1078 to 1.725 ppm. Nitrite determination is done colorimetrically using the Greiss reagent method. This method is based on the reaction of nitrite with sulphanilamide acid and N-1-napthylamine (NED) utilizing diazo coupling, and a syringe is used to administer the nitrite solution. The sample cell being used possesses a diameter of 1 mm with an overall size of 7.35×22 mm^2. To gauge the direct absorbance, a wavelength range from 400 to 650 nm has been selected for the testing, and the maximum absorbance is found to be at 545 nm. The validity of the proposed cell is explained in this letter.

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Nitrites (NO_2) are natural inorganic ions, which are a part of the nitrogen cycle and are omnipresent within the environment. These ions also exist in preservatives, fertilizers, and can act as a meat curing agents[1,2]. The threshold exposure limit for the level of nitrite in drinking water is 45 μg·mL^{-1}[3]. Precise measurement of nitrite compound is needed for great practical significance and fast determination of nitrite content in every related product must be done rapidly using the appropriate methods[4].

Overconsumption of nitrites that are found in food or water can be harmful to the metabolic system because they can cause methemoglobinemia, a situation where exogenous oxidizing drugs, including nitrite, reduce the carrying capacity of haemoglobin to carry oxygen[5,6]. Nitrites can also damage the nervous system, spleen liver, and cause cancerous tumours[2]. Ensafi *et al.*[7] previously reported that the formation of N-nitroso compound as a result of the reaction between nitrite and secondary amines, is known to be carcinogenic, tetratogenic or mutagenic.

Numerous researches have been conducted to find the most sensitive, effective, and rapid methods to detect and determine the concentration of nitrite, including electrochemical[8], capillary electrophoresis·[9], chromatography[10], spectroscopic[11,12] and test strip sensor[13]. However these methods own several major disadvantages such that they are time consuming, heavily dependant on sophisticated equipments and skilled expertise, and are unsuitable for real time applications[14].

The most common process used in determining nitrites is based on reduction of nitrates into nitrites using various reagents such as cadmium[15], phosphomolybdenum[16] and titanium III chloride[4], followed by Griess reagent reaction to detect the presence of nitrite compound, and using spectrophotometric method for measurement.

The application of optical sensors for the detection of nitrite is proven to offer satisfactory results based on previous researches. This method has noticeably high sensitivity and selectivity while being relatively easy to handle[7] Many researches have began to employ optical sensing integrated with flow injection for nitrite determination[17].

Plastic optical fibre (POF) is a popular choice for the application[18,19]as a chemical sensor for the determination of cations and anions due to its excellent sensitivity and ease of fabrication[14]. POF also has low fragility as compared to other types of fibre, the material used in the fibre structure is solid and non toxic, plus POF only needs low power in order to operate, making it biocompatible with the human body. Hence, POF is chosen as the sensor to detect nitrites in this research.

Polymethyl-methacrylate (PMMA) is a type of polymer material that is well utilized usually for the construction of a fibre optic body. However in this experiment PMMA is employed as a sample cell due to its compatibility with organic material, while taking advantage of the material's break- resistant option, lower density of 1195 Kg·m^{-3} as compared to silica, and low weight to assist in the flow injection set up for the determination of nitrite within aqueous media[20].

Flow injection analysis has been employed as an analysis method for many years, which has been properly recorded. This form of analysis is done by injecting the analyte into the reaction zone and the analyte will flow through the point of detection. Any changes in absorption, electrical capacity or any other physical parameters can be detected by the movements of the analyte in the flow[16,21]. The advantages of using flow injection include accuracy, rapidity, and it only requires a small amount of sample for the measurement[17].

The nitrite sample was prepared by diluting 0.0138 gram of sodium nitrite with 200 ml of deionised water

to yield 5 samples with different concentration: 1.725, 0.8625, 0.4132, 0.2156, and 0.1078 ppm. These solutions underwent the colorimetric Griess reagent reaction process by diluting 1 mL of each sample with 1 ml sulphanilamide solution, producing 1% concentration in 5 % acid. Then, 1mL of 0.1% N-1 napthylamine (NED) is added and each solution is incubated at room temperature for 10 minutes.

The flow injection using PMMA sample cell was developed in this experiment. The sample cell would be utilized to carry out absorbance spectroscopy. It has a square geometry with two holes for SMA connectors and a 1-mm diameter hole for injecting the solution, pumped through a small pipe using a syringe to the detection area.

The experimental setup of flow injection using PMMA as the sample cell for nitrite determination is presented in Fig. 1. A unit of ultraviolet-visible-near-infred (UV-VIS-NIR) light source (DH-2000-BAL, Ocean Optics, USA) with deuterium and halogen power input was used as the light source. A 364-element CCD array Toshiba detector acted as the receiver and was connected together with an optical spectrometer (Model HR 4000, Ocean Optics, USA) for the purpose of spectral measurement. Light propagated through the sample using a POF with a diameter of 1 μm. A SMA connector was used to couple the fibre to the sample cell, through which the solution was injected to the sample cell using a syringe.

The absorption spectrum coefficients of the different nitrite samples are shown in Fig. 2. It shows the absorption of nitrite at various levels of concentrations in the wavelength range of 400–650 nm. The maximum absorbance was observed at 545 nm because nitrite ions reacting to sulfanilamide under acidic conditions to form diazonium cations in acidic solution[22]. According to previous research, reaction of nitrite ion diazotizing with colorimetric method for nitrite determination will be detected at range from 540 to 545 nm[23] due to sequence of this research presence of nitrite can be detected in small amount. The light couple directly without any media that is preclude direct interaction between the light and nitrite. So that as depicted in Fig. 2, the amount of absorption increases with increasing concentration of nitrite samples. The sensor system showed good advantage because of the following two factors. Firstly, the direct interaction between nitrite and light without any hindrance of sample cell during nitrite measurement. Secondly, the small diameter of cell could efficiently reduce the nitrite sample dispersion and simplify sample displacement to the interaction spot and generate absorbance with colorimetry method leading to improvement system and response time. This sample cell proposed to replace the conventional cuvette that's used for nitrite determination in direct absorbance.

Figure 3 shows that the absorbance varies linearly with the concentration of nitrite. According to Beer–Lambert law, absorbance increases in a direct proportional fashion with the level of nitrite. The calibration curve is an alternative form of plotting the dispersion of the sample concentration versus absorption in the targeted wavelength. The calibration curve illustrates the linear line and allows for the calculation of the correlation regression coefficient. It can be seen that the dispersion plot does not deviate far from the linear plot line, with similar regression balancing the two parts of the upper and lower lines looking almost linear. Five concentration levels (ranged between 0.1078 and 1.725 ppm) were used to build the calibration line. The entire experiment was then repeated three times for each concentration. This

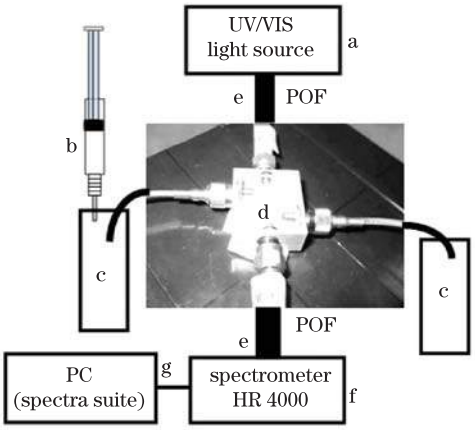

Fig. 1. Experimental setup of flow injection. a: broad band light source; b: syringe; c: nitrite sample container; d: sample cell; e: polymer optical fiber; f: optical spectrometer; g: computer.

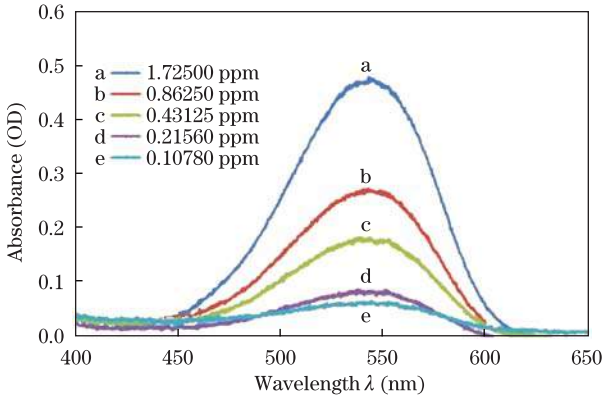

Fig. 2. (Color online) Absorbtion spectra of the presence of nitrite in aquous media: (a) 1.725, (b) 0.8625, (c) 0.43125, (d) 0.2156, and (e) 0.1078 ppm.

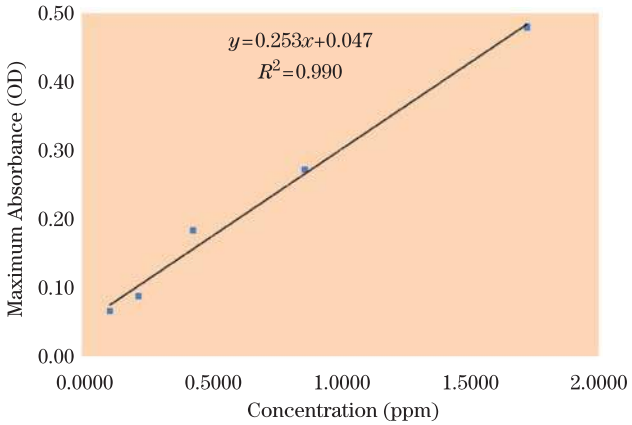

Fig. 3. (Color online) Calibration curve of nitrite concentration versus maximum absorbance.

Table 1. Optical Characteristic of Nitrite

Parameters	Unit	Characteristic
Colour	–	Purple
λ_{max}	nm	545
Beer Law Range	$\mu g \cdot ml^{-1}$	25–1.5625
Molar Absorptivity	$LMol^{-1} \cdot cm^{-1}$	1.7620

Table 2. Regression Equation of Experiment

Regression Equation[a]	y=0.2538x+0.0479
Correlation Coefficient	0.9902
Slope (a)	0.2538
Intercept	0.0479

subsequent process then yielded a linear calibration equation of $y = 0.2538x + 0.0479$. y-axis represents the maximum absorbance result, while x-axis represents the concentration, with a correlation coefficient of R =0.9902.

As indicated in Table 1, the nitrite sample gave out a purple colour due to diazo coupling as a result of using Griess reagent reaction to form colorimetric. The maximum absorbance was found at the wavelength of 545 nm, and the molar absorptivity was found to be 1.7620 $LMol^{-1} \cdot cm^{-1}$.

The correlation coefficient of 0.9902 from Fig. 3 and Table 2 shows a strong linear correlation coefficient with the value approaching, dictating an almost linear trend. Therefore, it can be said that the sensor used in this experiment almost obey the Beer-Lambert law with only a small deviation. The intercept of the regression line and the slope of the line are at 0.4252 and 0.3074, respectively.

In conclusion, we design and develope a flow injection analysis setup using PMMA acrylic as the sample cell for sensitive measurement of nitrite in aqueous media, having the sample concentration ranging from 0.1078 to 1.725 ppm. This sample cell is found to be sensitive in determining the amount of nitrite at lower concentrations. The utilization of PMMA as the sample cell is an accurate decision since this material is compatible with organic material. A broad band light source and a HR4000 spectrometer are used as the power source for this experiment. The obtained results successfully demonstrate the effectiveness of flow injection with acrylic sample cell for nitrite compound measurement in water, with the setup displays good sensitivity. This reveals the potentiality of the system for measuring nitrite concentration in drinking water and for monitoring water quality in wells and sewage system.

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Book Review

Sociocultural Theory in Second Language Education: An Introduction through Narratives, by Merrill Swain, Penny Kinnear & Linda Steinman (2015, 2nd ed.). Multilingual Matters Textbooks, 192 pages, Paperback £19.95, Hardcover £69.95, ISBN: 978-1-78309-317-5.

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Vygotsky's sociocultural theory of mind (1978) highlights the interdependence of the individual, social community and interactions in the construction of knowledge. The theory has been widely adopted in the area of applied linguistics research, and it has been employed to explain second language learning processes (Storch, 2013). The stated aim of this 192-page book is to introduce the key concepts of sociocultural theory (SCT), including mediation, zone of proximal development, collaborative dialogue, private speech, everyday and scientific concepts, the interrelatedness of cognition and emotion, activity theory and assessments. As is posed on the cover of the book, these key notions of SCT are illuminated within the narratives to which the authors, Merrill Swain, Penny Kinnear and Linda Steinman**,** link various contexts of second language learning, teaching, testing, and research. Although major concepts discussed in the book originate from its first publication, this second edition provides the readers with more recent studies on Vygotskian SCT in second language education. The authors have also completed the book with references from all of Vygotsky's collected works that appear in the bibliography.

Sociocultural theory in second language education: An introduction through narratives, comprises eight chapters which follow a brief introduction from the authors. The book, in some respects, may be regarded as a narrative because the authors occupy all the eight chapters with stories related to language teaching and learning. In total, there are ten stories presented within the eight chapters. The authors purposefully employed these ten stories to illustrate one or more concepts of SCT and to create engagement between the theory and its classroom practice. The characteristics and context of the story are also presented by the authors to help readers follow the discussion and build a connection between SCT concepts and language learning practice. At the beginning of each story, the key principles of SCT and the working terminologies are briefly introduced to maintain the readers' focus

when reading. The authors' in-depth evaluation and relevant research related to the topic appear after the story and discussion questions are posed to readers to evaluate their understanding of the SCT concepts and their criticality. More importantly, the authors remind readers that the stories themselves are not the primary units of analysis in the book (p. xiii); nonetheless, they serve the SCT concepts which are so. Finally, a discussion is presented to the readers after the main chapters in order to review the concepts of Vygotsky's sociocultural theory they are already familiar with.

The first chapter *Mona: Across time and geography* illustrates the SCT tenets related to mediation. In Vygotsky's SCT, all forms of human higher mental (cognitive and emotional) activity are mediated by material and/or symbolic means (also known as artefacts). Within the chapter, mediation is explained as "the process which connects social and individual" (p.149). Mediational means refer to tools that individuals use to achieve their interactional goals. Through Mona's narrative, the authors highlight several mediational means that Mona used to attain her English learning goals, including grammar books, computers, English language lessons played on the radio and TV, tapes, her first language, and her social interactions. This book provides valuable insight for classroom language teachers to consider any classroom resources that may potentially mediate pupils' learning activity and teachers' instructional goals.

The concept of the zone of proximal development (ZPD) is demonstrated in chapter two, *Madame Tremblay: A French immersion story*. Madame Tremblay, a story written by Sarah who attended primary education in a Canadian French immersion program, resonates a number of interactions that enable learners to accomplish more than he/she could have accomplished if working alone; what is known as the ZPD. It is interesting that the authors perceive ZPD as a collaborative and dialogic interaction rather than a metaphor as ascribed by John-Steiner and Mahn (1996). The authors' argument that ZPD is an activity primarily relies on their grammatical and lexical interpretation of the term. In addition to the authors' attempt to define ZPD, they take issue with what is called intersubjectivity within the ZPD. The authors argue that a ZPD involves a number of individuals and thus suggests co-authorship or co-construction. To provide readers with clearer analysis of the *Madame Tremblay* narrative, the authors discuss two other related social theories, including scaffolding and community of practice (CoP).

Chapter three presents two narratives, namely *Jody (talking to self)* and *Sophie and Rachel (talking to others and self)*. However, the two narratives elaborate one same concept

of SCT, being that of languaging. From the two narratives, the authors show how languaging plays a salient role in promoting individuals' thinking processes. In Jody's narrative, the authors demonstrate the process of internalising language aspects through self-talk whilst in Sophie's and Rachel's, the authors suggest the role of collaborative dialogue in language learning. In spite of the authors' presentation of the two types of languaging (i.e private speech/self-talk, and collaborative dialogue), they contend that the use of the two terms appears to be interchangeable. The authors write, "what looks like collaborative dialogue may on closer inspection also be considered as speech for the self" (p. 32).

Thaya's narrative depicting Vygotsky' concepts of scientific (conscious, systematic) and everyday (spontaneous) language and their interconnection is the topic of chapter four (*Thaya: Writing across languages*). Contextualised in a writing classroom at the University of Ontario, the narrative is employed to illustrate "how students, especially Thaya, move between their everyday and scientific concepts to build their writing skills and sensibilities as well as a more conscious understanding of the writing process" (p. 50). To this end, the authors distinguish between Vygotsky's concepts of scientific (conscious, systematic) and everyday (spontaneous) language and evaluate the implications of these concepts when applied into language teaching and learning classroom practice.

In chapter five, entitled *Grace: The effect of affect*, the authors discuss the SCT concept of affect by demonstrating the interrelatedness of cognition and emotion in a learning process. From a SCT perspective, the involvement of acting, thinking and feeling is critical mainly when learning in the ZPD because not only does it suggest participation, but it also transforms learners' identity (Wells, 1999). Drawing upon Grace's narrative, the authors argue that thinking (cognition) and feeling (emotion) are inherently related and separating the two may limit individuals' complete understanding of their learning. To support this argument, the authors provide some evidence from research regarding the role of emotion in classroom language learning. Additionally, two other relevant concepts, including identity and regulation, are discussed to help readers better understand the concept of 'affect' and its value in language learning.

Sandra's narrative illustrates the key SCTs concept related to activity theory and it is presented in chapter six, entitled *Sandra's story: A teacher's dilemma.* Within the chapter, the authors present an activity theory perspective, claiming that human construction of knowledge is a physically and socially motivated activity. The focus of activity theory, as the authors argue, is on "the interaction of multiple individual and social forces rather than on an

individual" (p. 96). At this point, the authors evaluate Sandra's (teacher) and Marc's (student) email exchange and they reflect three primary elements in an activity system, namely subject (agent), object (goals) and mediational means. Sandra's tension within herself regarding her role and objectives during the many interaction between herself and her student is also illustrated to clarify the interconnectedness of the three elements. Of the complex networks within an activity system, the authors emphasise the rules (e.g. level of formality, languages), community and division of labour. At the end of the authors' discussion, they raise controversies related to the activity theory and challenge for the reconceptualisation of the relationship among learning, the individual and the context in order to suggest a view of learning for language teachers and scholars.

Chapter seven – *Yang: Being assessed* – recounts Yang' story in preparing a high-stakes exit test after attending an Academic Preparation Program at a Canadian university. Within the context of an English for academic purposes speaking course in Canada, the story exemplifies the potential contribution of SCT for second/foreign language assessment. Assessment itself is viewed as the process of documenting students' language learning, and its practice is a social and cultural activity. The authors argue that assessments "reflect the values and belief of the broader society in which they are developed and used" (p. 121). A debate about dynamic assessment is briefly presented as it has been considered for second language assessment. To this end, the authors discuss the story with a focus on second and foreign language testing as a mediated, goal-driven activity with social and educational implications.

The final chapter (chapter eight), entitled *Maria and the Beatles; Jean-Paul and Second life,* presents additional narratives from Maria and Jean-Paul. The first story of Maria presents a dialogue between two teachers who look to the Beatles for inspiration. The other, Jean-Paul's story, moves the discussion from the traditional classroom into a digital environment, specifically Second Life. In this chapter, the authors attempt to engage readers with the process of trying to understand the situation through SCT principles. Readers are given an opportunity to consider and evaluate the two additional narratives with the SCT concepts they already comprehend.

Overall, this second edition of *Sociocultural theory in second language education: An introduction through narratives,* is an exceptional discussion of SCT concepts that serves readers with an accessible entry to complex principles of Vygotsky. Despite the fact that the title of each chapter appears to drive attention towards one concept of SCT, the authors exceptionally establish the interrelatedness of Vygotsky's principles so that readers may gain

a complete understanding of the theory. Following Richard Donato's remarks about the book as shown on the publisher's website, it is a highly recommended and worthwhile read, not only for graduates and undergraduates as addressed by the authors, but also for language teachers or other newcomers seeking to understand the interaction between sociocultural theory and language classroom teaching.

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Using Technology in Foreign Language Teaching (Book Review)

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Using Technology in Foreign Language Teaching, Edited by Rahma Al-Mahrooqi & Salah Troudi (2014). Cambridge Scholars Publishing, 320 pages, Hardcover £52.99, ISBN: 978-1-4438-6522-7.

The integration of information and communication technology (ICT) into foreign language (FL) learning classroom not only suggests learners' positive attitude towards learning (e.g. see Li, Chu, & Ki, 2014) but also transform the language learning and literacy acquisition atmosphere as well as the dynamic of language learning settings (Young, 2003). The book entitled *Using Technology in Foreign Language Learning* aims to explore underwhich conditions technologies used in the learning environment can best be utilized. To achieve this objective, this 13-chapter book with an introductory chapter by the book editors examines the ICT integration into FL classroom learning from the perspectives of actual users and professionals from different countries namely the United Arab Emirates, Saudi Arabia, Oman, Iran, and Malaysia. Six main issues are addressed in this edited volume including (1) the principled approach to integrating technology into course design, (2) approaches to the evaluation of computer-assisted language learning software (CALL) software, (3) the practice of blended learning, (4) teachers' view on technology integration, ICT knowledge and computer skills, (5) the practice of online learning in FL classroom setting, and finaly (5) the use of digital application, and Theories on integrating technology into language teaching practice are also discussed along with a brief summary of each chapter. Readers could benefit from this provision that they can choose which of the chapters may meet their needs and conditions. It is interesting that the book chapters are predominated by a number of studies that were conducted in diverse educational settings and employed using a variety of research methodologies. Moreover, pedagogical implications from the study are presented at the final section of each book chapter. It is therefore, as the editors argue, the book may provide evidence and suggest valuable insights for FL professionals, researchers as well as postgraduate students specifically regarding the ICT integration into FL classroom settings.

In the introductory chapter, the editors, Al-Mahrooqi and Troudi, provide a brief history of computer technology in language learning setting, its advantages as well as challenges that teachers may encounter when incorporating technology in classroom teaching practice. The editors also emphasise some crucial requirements that an FL institution have to meet for incorporating technology such as a solid infrastructure, teachers' and students' attitude towards computer and their computer skills.

A synthesis of relevant literature on approaches for technology integration is discussed in two chapters: chapter 1 and chapter 13. Chapter 1 *Blended learning in EFL: Adopting a principled approach to integrating technology,* authored by Claire Whittaker, focuses on a principled approach for technology integration within a blended learning environment. Whittaker's discussion in chapter one might be considered as both a short summary and improvement of her early works which appeared in Tomlinson and Whittaker (2013). Only in this chapter, she promotes her thoughts on "how to achieve the principled approach to integrating technology into courses by determining the degree of overlap, the drawbacks and suggesting how we can proceed from this point" (p.8). Whittaker perceives the principled approach as "a systematic approach to the design process that is driven by pedagogy, that adds value to learning, and that is underpinned by language learning theory" (p.9). In order to attain a principled approach for technology integration into a blended language learning course design, Whittaker evaluates various framework and principles. What fundamental from the chapter is that the frameworks and principles

addressed by the author seems to fit Reem Al Elbaikan and Salah Troudi's and Richard Peel' research that appear respectively in chapter 2 and 7. Those who are newcomers in incorporating technology within the field of foreign language teaching and learning, thus, will find this chapter beneficial as it also explores the shift of paradigm emphasizing "how various technology can be employed in language teaching to giving pedagogy a central role and organizing activities in the areas of language learning" (p.8).

Review of related literature for technology integration is also discussed in chapter 13 entitled *Approaches to the evaluation of computer-assisted language learning software*. In the chapter, the authors, Vahid Nimehchisalem and Jayakaran Mukundan attempt to seek a proper method for CALL software development and evaluation. They examine the various evaluative criteria and/or instruments suggested by ELT scholars for software evaluation (p. 286). Nimehchisalem and Mukundan argue that the recent frameworks available in CALL literature do not suggest a balanced representation of technical and pedagogical aspects required when evaluating CALL software. For example, the evaluation framework provided by software companies does not satisfactorily address the language skills while the instruments developed by ELT scholars pay much attention to the skills and less focus on technical features in the survey questions. Alternatively, they suggest the need for "a balanced focus on both predictive (before use) and retrospective (while or after use) CALL software evaluation" (p. 298).

The rest of the chapters in this edited volume report eleven studies from two different settings: blended learning environment and online learning setting. Two research reports on the practice of blended learning within FL classroom setting are presented in chapter 2 *Blended learning in Saudi Arabia: Potential for its use in EFL at the tertiary level* and in chapter 7 *Challenge and change in online reading: Learners' perception of textbooks and reading online*. In chapter 2, the authors, Ebaikan and Troudi, discuss their study on the potentials of adopting blended learning for EFL teaching and learning in Saudi Arabia. The study is interesting as its findings provide "insights into blended learning's potential for the teaching especially women in Saudi context" (p. 31). The authors believe that blended learning may increase the effectiveness of learning processes regarding the Saudi's culture that segregate sexes in all aspects of life including education (p. 37). Chapter 7 reports Richards Peel's study exploring the use of textbooks and reading online in the blended learning environment in the United Arab Emirates (UEA) context. While in the chapter two the emphasis is on "the essential role of the face-to-face element of blended courses" (p. 30), in this chapter seven, Peel attempts to examine learners' perceptions of the use of traditional textbooks and online reading (via the Internet and through programmes such as BlackBoard Vista [BBV]). The finding is quite surprising as it suggests that the online reading is less popular despite students' positive perception of the usefulness of online reading course (see p. 148). Some plausible factors that contribute to the findings as identified by the author include generational differences (digital natives, digital immigrants, and digital illiterates), learning style preference, learner types (visual learners, auditory learners, kinesthetic learners and read-write learners).

The practices of online learning in FL classroom setting are presented in seven chapters: chapter 3, 4, 5, 6, 8, 9 and 12. Chapter 3 entitled *Self-access or access to self?: Experimenting with e-learning in Oman* presents a fundamental view on learner autonomy and learner independence. The authors, Alina Rebecca Chirciu and Tulika Mishra examine "the relationship between self-access learning and self-directed learning in English language education in Oman, by presenting the case of a higher education institution and its implementation of an e-learning platform" (p. 45). The finding of their study suggests that teachers' motivation and autonomy correlate with student motivation and autonomy. Chirciu and Mirsha write, "Student motivation to engage in self-access is directly proportional to the teachers' motivation to engage in it too" (p. 55). Chapter 4 *Integrating information and communication technology (ICT) into EFL classroom practice at Majma'ah university* and chapter 5 *Critical approach to integrating ICT into second language learning* follow up the view presented earlier in chapter 3 by demonstrating teachers' perspective of technology integration, ICT knowledge and skills. Teachers' use of ICT is also accounted within these two chapters.

In chapter 6 entitled *IT and L2 writing skills: EFL students' perceptions of e-feedback on their essays*, the authors, Susan Riley and Alireza Zareekbatani address two issues: (a) the advantages as well as the limitations of the use of information and communication technology (ICT) application in corrective feedback provision, and (b) L2 learners' perspectives on using e-feedback to reduce their local and global mistakes (p. 106). Chapter 8 *The internet chat room: A tool for promoting learner*

autonomy reports Jo Mynard and Salah Troudi's study that examined ten new students' autonomous language learning when participating in a classroom-based chat room. Mynard and Troudi highlight some factors that suggest students' engagement with the learning activity enhanced by technology including students' motivation, individualised learning opportunity, design of the task, interaction, the effect of virtual learning environment. Kirsten Gear' study that is presented in chapter 9 *The self access centre WebQuest* still makes an issue related to learning autonomy. In her study, Gear focuses on promoting authentic materials as well as learner' learning independence through the use of WebQuest. She applied a constructivist-based student centred learning (SCL) platform in order to develop student-centered EFL and ESP WebQuests. In chapter 12 entitled *Online language corpora: Implications for EFL teaching*, Shaimaa Abd El Fattah Torky emphasises on the potential use of online language corpora for EFL learning. She evaluates "the practical implications of integrating corpus consultation into the EFL learning environment" (p. 253). Torky suggests an eclectic method to respond challenges in incorporating online language corpora into EFL classrooms.

The use of digital application in classroom setting is presented in two chapters. Al-Mahrooqi and Naqvi's study on ICT integration into digital video project-based instruction appears in chapter 10 entitled *Fostering EFL students' language development via student-created digital videos*. The result of their study shows that students positively perceived the ICT integration into their digital video project based learning activity. More importantly, the study revealed students' improvement on their vocabulary, reading and oral written communication ability. In addition to Al-Mahrooqi and Naqvi, Sandhya Rao Mehta explores the potential use of digital literatures in ELT and their discussion appear in chapter 11 *Is small really beautiful? Exploring digital literatures and their relevance to English language teaching (ELT).*

Overall, the book provides a comprehensive discussion in the area of CALL, specifically the practices of blended learning and online learning. The focus on learning autonomy and motivation which is promoted throughout the pracitice of blended learning and online learning is deliberately maintained by almost all the authors in the book. The fact that the book is composed by actual users and professionals and their writing is based upon academic research suggests evidence-based exploration of blended and online learning within EFL classroom environments. The contexts provided in this book are limited to higher education institutions within Arab countries. This may explain why gender issues in FL classroom is so concerned in the book and are successfully addressed by some of the authors.

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USING *QUIPPER* AS AN ONLINE PLATFORM FOR TEACHING AND LEARNING ENGLISH AS A FOREIGN LANGUAGE

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Abstract

This paper evaluates the affordability of *Quipper* as an online platform for teaching and learning English as a foreign language (EFL). It focuses on the extent to which features available in *Quipper* may correspond to fundamental components of Computer-Assisted Language Learning (CALL) pedagogy, as suggested by Chapelle (2003), including L2-input exposure, interaction and linguistic production. The evaluation results indicate that *Quipper* is affordable for use as an online teaching and learning EFL platform. More importantly, it corresponds to the three conditions of CALL pedagogy, thus making it a potential aid for activities used in teaching and learning foreign language.

Keywords: Online platform, learning management system (LMS), teaching and learning English as a foreign language (EFL), computer-assisted language learning (CALL).

1. Introduction

The advanced development of Information and Communication Technology has provided excellent opportunities for teachers and students to experience English language teaching and learning activities beyond their traditional classrooms; that is, through online learning. Literature on the use of technology in EFL classrooms has suggested a number of benefits from using online learning modes, such as the Web, wikis, blogs and other online learning platforms, on the development of students' language skills (for example, see Alshumaimeri, 2011; Jung, Kudo, & Choi, 2012; Sun & Yang, 2015).

Furthermore, many ELT professionals and ICT practitioners have written reviews about technology for classroom use to help teachers to keep updated with information about types of technology suitable for language teaching and learning. In the *Teaching English with Technology Journal*, I noted four interesting reviews, namely those by Ciaffaroni (2003); Elturki and Hussein (2011); Kiliçkaya (2007); and Michalak (2015). Unfortunately, there are still few articles in the journal that evaluate learning management systems (LMS) for the teaching and learning of English online.

In this paper, I will examine the use of *Quipper* as an online platform for EFL learning. Specifically, I will evaluate the affordability of *Quipper* from a technical perspective; that is, whether or not some features available in *Quipper* help teachers expose students to L2 input, facilitate interaction among teachers, students and between teachers and students, and whether they promote students' linguistic production. To help readers understand the following discussion, I will provide a brief definition of two terms used in online learning and LMS. The term 'online learning' (also known as 'e-learning') is used to explain the use of the Internet as a technological tool that enables users to interact with the content, with other users; and to get support during the process of learning so that they can acquire knowledge, construct personal meaning, and to experience learning (Ally, 2008).

In addition, the term 'learning management system' (LMS) is described as an online learning platform, software that is devised to organise and manage learning (Anderson, 2008; Paulsen, 2003). More specifically, LMS is defined as a "systemic infrastructure that manages the learning process of an entire organization" (Watson & Watson, 2007, p. 28). LMS is characterised by three fundamental features, namely the creation of course tools (the creation of modules, learning materials and group work), student and tutor support tools (access to learning materials, teacher-students and student-student communication) and administrative systems (registration, course enrolment, and grouping students – Paulsen, 2003).

The paper is organised according to five sections. Section 2 that follows provides an overview of *Quipper*. Section 3 informs the readers about the basic operation and features of *Quipper* that have potential for foreign language learning. The evaluation of *Quipper* features is presented in Section 4 and, finally, conclusion and recommendations are offered in Section 5.

2. An overview of *Quipper*

Quipper, also known as Quipper School, is a web-based online learning application. It was originally developed by Quipper Ltd. located in London. *Quipper* opens its representative offices in four countries, namely Japan, the Philippines, Indonesia and Mexico.

Quipper has been used by millions of teachers and learners around the world, including those in the Philippines, Indonesia, Thailand, Mexico, the United Kingdom, India, Russia and Turkey. This may be why some languages available on *Quipper* correspond to those countries, including English, Japanese, Filipino, Bahasa Indonesia, Mexican-Spanish, and Thai.

Unlike other similar web-based learning management platforms such as *Moodle*, *Claroline*, *ATutor*, *Omeka* and *Docebo* that need installation on an existing hosting site (or a web server), *Quipper* provides teachers and students with a ready-to-use web-based learning application. It also supports teachers via virtual storage that allows them upload and keep their PowerPoint presentations, PDF files, pictures and videos online. Furthermore, the storage helps teachers maintain their teaching and learning activity records on the web server; thus, they can monitor their students' learning without encountering constraints of time and place. It is interesting that the use of these facilities in *Quipper* is completely free, although it requires registration.

3. Basic operation and features

Quipper is available online at http://school.quipper.com. The system is user-friendly as *Quipper*'s menu and sub-menu feature a simple design and accordingly, users can navigate all facilities available on the system with ease. This ease of using technology, as argued by Teo, Lee and Chai (2008), may promote users' positive attitudes towards the particular technology (such as *Quipper*), and may eventually be a contributing factor to using it.

Figure 1. *Quipper*'s welcoming screen.

To start using *Quipper*, both teachers and students are required to sign up for an account. They can either use their *Facebook* accounts or create a new, free *Quipper* accounts. To get a free account, teachers and students need only to provide an email address, telephone number, and the name of the school. If their school has already registered in the *Quipper*

database, teachers then can make a request to the *Quipper* ambassador at the school to assign their account into the virtual school classroom.

After registration, users can then log in into the system with the username and password they have already created. What is important to note is that *Quipper* will initially ask the user's role when logging into the system (see Figure 1). There are two roles for users: teachers and students (see Table 1). Each of these roles allows different access to *Quipper*'s three main features, which are 'Creation', 'Assessment' and 'Learning'.

Table 1. Menu and sub-menu in *Quipper*'s dashboard.

Role	Main menu	Sub-menu
Teachers	Overview	Overview, performance
	Assignments	Assignments, examinations
	Curriculum	Curriculum
	Message	Message (personal), announcement
	Manage	Students, groups, teachers
Students	Assignment	To do, try it again, mastered
	Messages	Messages, notices
	Study notes	Study notes

The 'creation' feature deals with setting up the learning classroom, the materials and the student participants. The 'assessment' feature facilitates teachers' use of the learning materials (lessons and quizzes) and assigning them to students. Learners then access these learning materials on the 'learning' feature. In addition to the three main features, *Quipper* provides a help facility (displayed as a question mark icon) to help teachers and students to understand the functions of each menu.

The 'teacher role' enables teachers to have full access to *Quipper*'s three main features. The role also grants teacher access to 'overview', 'assignments', 'curriculum', 'message' and 'manage' menus. The 'overview' menu provides brief information about active assignments submitted by the students ('overview sub-menu'), and students' individual performances ('performance sub-menu'). The 'assignment' menu allows teachers to create new assignments, distribute them to students and monitor their progress. The 'curriculum' menu offers two options for teachers regarding the learning materials; they can either use the materials available on the *Quipper* database, or they can develop their own materials and use them to teach their students. The 'message' menu has two functions; firstly, it facilitates

teacher-student communication, and, secondly, it allows teachers to distribute notes to all students. Finally, the 'manage' menu allows teachers to select course participants, group the students, and invite other colleagues to teach collaboratively within the virtual classroom.

The 'student' role is limited to accessing *Quipper*'s learning features. As shown in Table 1, three main menus on the student dashboard include assignments, messages and study notes. The assignment menu informs students about tasks that need to be completed. The menu also notifies them about the tasks they have already done and their level of mastery. In addition, the 'message' menu allows learners to interact with their teachers and peers. Unfortunately, this facility is suitable only for communication between two individuals, which may make group discussions difficult. The other study note menu allows students to write personal notes related to a topic or an assignment. It is important to highlight here that student users can only access the learning materials according to the classroom (course) already provided by their teachers.

4. Evaluation

In this section, I will evaluate *Quipper*'s features in terms of its affordability as an online English teaching learning platform. Special focus will be placed on whether or not these features address the three conditions of CALL pedagogy suggested by Chapelle (2003): L2-input exposure, interaction and linguistic production. In order to do this, I attended a *Quipper*-mediated English teaching and learning activities at a senior secondary school in Indonesia. My role at that time was as a teacher.

4.1. Affordability of *Quipper*

Technically, the *Quipper* web application meets all three standards of online learning platforms as described by Paulsen (2003), namely the creation of course tools, student and tutor support tools and course administration. The course-creation tools on *Quipper* are easy to use, and the student- and tutor- support tools address both teacher and students' engagements in teaching and learning activities. For example, teachers can create a lesson that can be accessed by their students. Unfortunately, despite the availability of the administrative system, *Quipper* does not offer an administrative function. Teachers, therefore, need to set up a new classroom (course), create learning modules, and select the participating students themselves. This administrative workload may be challenging for some teachers to some extent, particularly for those who are not familiar with a web-based learning management system.

4.2. CALL pedagogy elements in *Quipper*

Chapelle (2003) suggests three conditions of CALL pedagogy that EFL teachers should consider when incorporating technology into language learning classrooms; these are the availability of L2-input exposure, interaction and linguistic production.

(a) *Quipper* features enhance L2 input exposure

According to Chapelle (2003), the use of computer technology in the classroom should bring benefit to learners through enhanced linguistic input. The three types of language input suggested by Chappelle are salience (e.g. interaction with a grammar application), modification (providing any means that help learners to arrive at the meaning, such as through images), and elaboration (providing explanations). *Quipper* addresses these types of enhanced learning input.

As a web-based learning platform, *Quipper* offers learners multimodal exposure (written, aural and visual) for foregin language input. For example, teachers can develop learning materials that are enriched by visual and audio media, such as text with illustration, images, videos or other multimedia resources. In order to do this, teachers can employ the multimedia tools available in 'lesson' and 'assessment' menus.

Figure 2. Embedded video from *YouTube.*

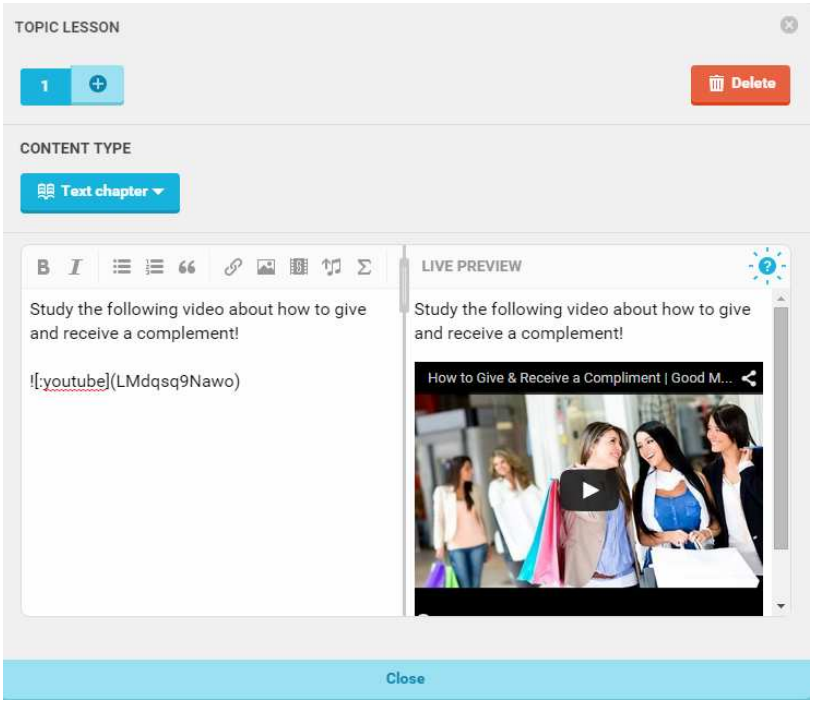


Figure 2 above illustrates how teachers can embed images, audios, or videos in the lesson content or in assignments. The incorporation of multimedia applications in the learning

materials in *Quipper* not only motivates students but also improves students' understanding of word meanings and linguistic forms from texts presented by the teachers.

Unfortunately, *Quipper* is not enhanced with a speech recogntition technology, technolgy that can identify or recognise words or spoken expressions. Such an absence reduces an opportunity for the students to interact with the computer verbally, thus, the learning of speaking is not feasible for the students.

(b) *Quipper* features promote classroom interactions

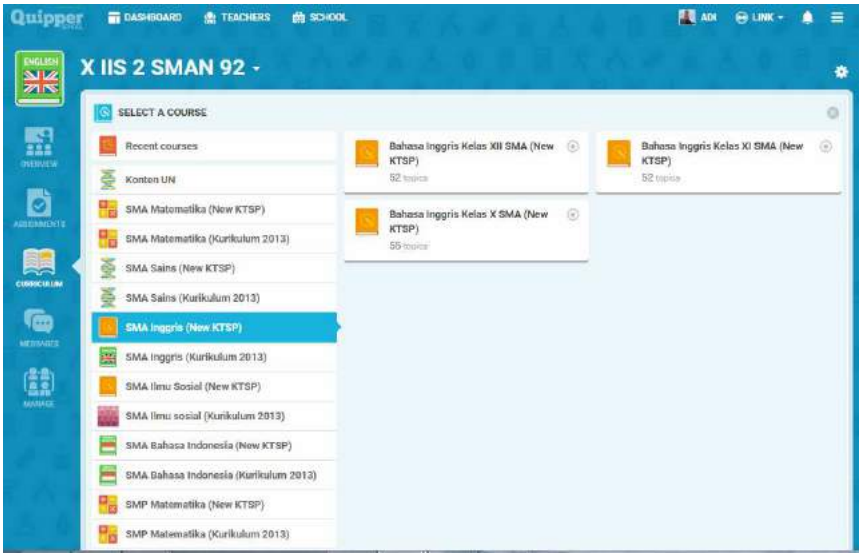
The use of CALL applications in EFL classrooms should also provide an opportunity for teachers and learners to interact, either within synchronous (real-time) or asynchronous (not-realtime) modes (Chapelle, 2003). Chapelle (2003) highlights three types of interaction that teachers should promote within language learning tasks: interpersonal interaction, learner-computer interaction, and intrapersonal interaction. In *Quipper*, teachers and students are given an opportunity to get engaged into interpersonal communication. The 'message' and 'announcement' features help teachers to interact with colleagues and students. In addition, teachers can work collaboratively with their colleagues when developing a learning curriculum, or can design lessons (assignments) for the pupils together. To do this, teachers initially need to invite colleagues into their classroom through the Teacher Page, via email or on the Class Page, as shown in Figure 3 below:

Figure 3. Inviting colleague to participate

In addition to interacting with colleagues, teachers can interact with the *Quipper* content developer through the 'curriculum' feature. The curriculum menu as shown in Figure 4 allows teachers either to develop their own curriculum (learning materials), or to use the

available materials developed by the *Quipper* content developer in the *Quipper* database. These teacher-colleagues and teacher-content developer interactions are advantages of *Quipper* that, as far I have observed, are not available on other similar online learning platform.

Figure 4. Curriculum available in *Quipper* database



In addition to teacher-student interaction, student-student interaction is offered through private messaging (peer-to-peer) and 'group work' feature. Unfortunately, the 'group work' feature does not provide room for students to discuss a particular topic or work collaboratively. In other words, the limited functionality of private messaging and group work features indicates that collaborative learning activities for students seem to be difficult to promote using these features.

What is interesting about the *Quipper* features for teachers, students, and teacher-student interaction is the integration with social media platforms such as *Twitter* and *Facebook*. This social media integration enables teachers to build social relationships with their colleagues and students effortlessly, and to monitor their students' interaction and the progress they have made without having constraints of time and place. Another advantage for students is that social media are integrated into the *Quipper* system because this not only helps students to socialise with their peers, it also keeps them updated about their learning progress. As argued by Donato (1994), social interaction may promote collective scaffolding that helps students perform the language they are learning beyond their linguistics ability.

With regard to intrapersonal interaction, *Quipper* provides useful tools called 'Hint' and 'Explanation' for the students' assignment. The 'Hint' and 'Explanation' features enable

teachers to give their students help (e.g. with clues or explanations) in order to answer questions on a test or in a assignment. They also provide an opportunity for students to stimulate their inner voice and become involved in deep cognitive processing of input (Chapelle, 2003). It is interesting that teachers can also use the 'Hint' and 'Explanation' features to provide learning feedback to their students, as such features can be accessed by students during and after they complete an assignment. These two types of students' access to the learning feedback are of course subject to teachers' personal choices when developing assignments for students.

In addition to interpersonal and intrapersonal interaction features, *Quipper* provides a chance for learners to interact with a computer, although this seems limited. Students can only interact with a computer through the lessons and quizzes previously set up by their teachers. The use of a flash application that enables more learner-computer interactions (such as language games and computer-user communication applications) is unfortunately not available in *Quipper*, as it requires teachers to have advanced computer skills.

(c) *Quipper* faciliates students' lingusitic production.

According to Chapelle (2003), the incoporation of technology in the EFL classroom should promote learning tasks that afford a wide variety of opportunities for learners to produce the the target language. Chapelle (2003) suggests that learners' language production within CALL tasks should provide students with chances to plan before speaking or writing, to receive feedback so they can correct their linguistic output, and to suggest a learning scaffolding.

Figure 5. Question types in *Quipper*

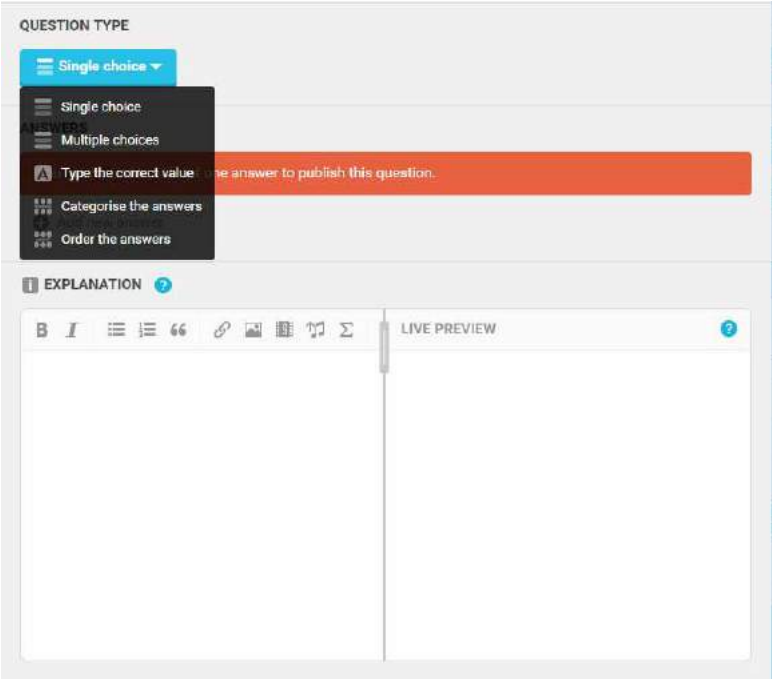
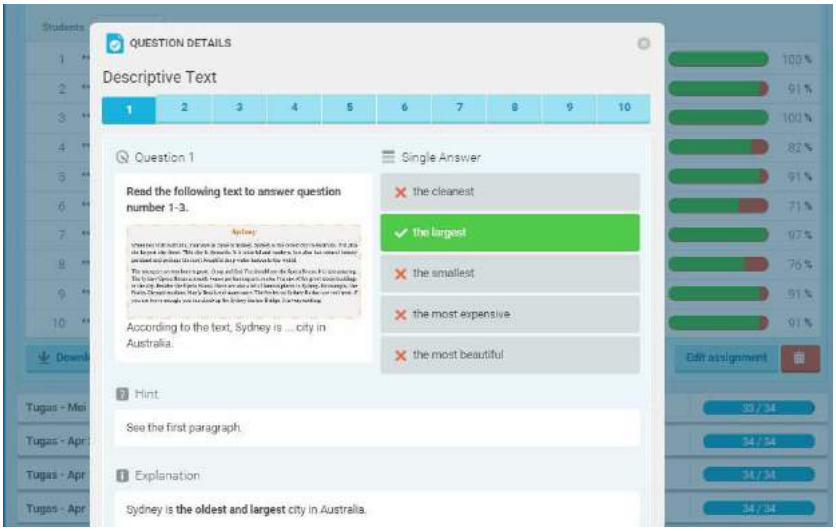


Figure 6. Feedback and explanation features on *Quipper*



In *Quipper*, students' linguistic production is facilitated through the assignment feature; however, production is limited to aspects of students' writing skills such as vocabulary and grammar. Question types in the *Quipper* assignment system include a single answer, multiple answers, correct values, correct order, and categorise answer questions (see

Figure 5). The limited range of question type is reason for such a limitation and they should therefore be brought to the attention of the developers for further improvement of the system.

5. Conclusion and recommendation

In summary, *Quipper* fits the three conditions for an online learning platform, which makes *Quipper* affordable for EFL teaching and learning. More importantly, *Quipper* addresses the three conditions of CALL pedagogy suggested by Chapelle (2003), which are L2-input exposure, interaction and linguistic production. Personally, I have attended virtual English learning classrooms designed using *Quipper* for four months as a teacher and found this online learning platform particularly useful for promoting independent learning for the students, with support from teachers as well as from their peers. The greatest value I perceived regarding *Quipper* was that the features were user-friendly, and it supported the school's English curriculum. I also found *Quipper*, as an online platform, to be a feasible alternative for teachers to assign learning tasks to students outside the classroom. This is because *Quipper* grants teachers access to monitoring students' engagement with the task and enables them to evaluate their achievements, particularly in the areas of students' learning to read, listen and write English.

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Herri Mulyono
Indonesia

The New Educational Review

Book Review: A. Maley & N. Peachey (eds.), *Creativity in the English Language Classroom*, British Council, 2015, 172 pp.

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Creativity is an essential element for effective and successful teaching and learning in school classrooms. Many sources have suggested that creative teachers can have an impact on the improvement of students' academic achievement (Fisher, 2004; Richards, 2013). Unfortunately, defining what is called 'creativity' is an elusive task (Fisher & Williams, 2004). It is so because creativity is a multifarious concept, which can be interpreted in different ways depending on how it is perceived, i.e., as 'a property of the actor', as 'processes', or 'products' (Fisher, 2004, p. 8). This book, edited by Maley and Peachey, is not particularly aimed to discuss the complex definitions of creativity, but it explores practical classroom activities that demonstrate what creativity is really about. It also presents classroom procedures that teachers can follow in order to promote creativity in real classroom practices.

The book comprises 18 chapters with a foreword, an introduction and an overview of creativity. It is very refreshing that these 18 chapters are written by 20 well-known English language teaching (ELT) researchers, practitioners and professionals. The chapters deal with practical classroom case studies that promote creativity within varied settings of English language teaching practices: within young learner contexts, secondary schools, adult learning environment and higher education settings. The exercise of creativity presented by the authors in the book chapters, therefore, can be regarded as good practices that teachers from all levels of English language education can adopt and experiment with in their contexts. In other words, the book addresses "the growing demand for more creative approaches to the teaching of languages" as expected by the editors (p. 12).

The overview section is fundamental for understanding the chapters that follow. In the section, one of the editors, Alan Maley, briefly discusses the what, the why and the how of creativity. What is important to emphasise is the use of lower case 'c' creativity across the book chapters that represents the construct of creativity on the basis of daily routine. Maley also provides a list of useful resources, which helps teachers encourage creativity in the classroom. Such a discussion and resources of creativity not only offer teachers some universal procedures for implementing creative ideas in classroom activities (p. 6), but also help readers follow the authors' arguments at ease.

The 18 chapters in the book are apparently divided into four themes, including approaches to creativity, creative individuals, creative classroom instructions, and creative use of instructional materials and media. Four chapters deal with approaches to creativity, namely chapter 3, 4, 10 and 15. In Chapter 3, the author, Carol Read, presents seven pillars of creativity that are fundamental in primary foreign language classrooms, including self-esteem, a creativity model, opportunities, creative questions, making connections, exploration of ideas and finally critical reflection. Although the author addresses these seven creativity pillars to the primary foreign language classrooms, they are still possible to be applied in higher levels of language education. In addition, Chrysa Papalazarou's writing in chapter 4 offers a visible-thinking approach to promoting creative thinking and, in chapter 10, Libor Stepanek shares his thoughts on how to improve teachers' communication skills in responding students' contributions to classroom activity. Finally, in chapter 15, Phoung thi Anh Le suggests the use of 'a reader-response approach' to encourage creativity in literature classrooms.

Chapters 12, 13 and 16 discuss creative teachers and students. Chapter 12, *Creating Creative Teachers,* addresses the need for creative thinking skills training. By citing her previous survey results (cf., Constantinides, 2014), the author, Marisa Constantinides, argues that teacher training courses so far have not provided opportunities for teachers to develop their ability to think creatively. Thus, in the chapter, the author offers some activities that promote the development of aspects of teachers' "cognitive make-up" (p. 115). Furthermore, chapters 13 and 16 focus on creative learners. In chapter 13, the author, Marjorie Rosenberg, discusses the learners as resources for creativity, whereas Tessa Woodward, in chapter 16, suggests a framework that facilitates the development of students' creativity.

The issues of creativity in language classroom instruction are addressed in eight chapters. In chapter 5, *Personal and creative storytelling: telling our stories*, David Heathfield argues that storytelling activities can be used to stimulate teachers' and students' creative communication. Jill and Charlie Hadfield discuss a creative

technique to teach grammar in chapter 6. Chapter 7, *From everyday activities to creative tasks,* shows teachers how to embed creativity in daily teaching activities. In chapter 8, the author, Jürgen Kurtz, focuses on creating an 'attractive learning environment that can facilitate the development of EFL students' oral creativity in classroom interaction (p. 73). Malu Sciamarelli's discussion on mascot-inspired projects in chapter 11 is really interesting. She suggests project-based learning activities that teachers can employ to promote creativity. In addition, chapter 14 and chapter 18 similarly suggest the use of creative writing to promote creativity in the language classroom, which makes the two chapters different is classroom settings. In chapter 14, Peter Lutzker describes the practice of creative writing for secondary school students, while in chapter 18, Zarina Markova focuses on primary classrooms. Such different settings thus influence the techniques and classroom procedures presented by each of the authors. In the last chapter, Victoria Hlenschi-Storie shares her experience of incorporating drama and creative writing as a blended tool to promote creativity. As she argues, both drama and creative writing can be alternative resources to stimulate teachers' and students' creative ideas.

Finally, creative use of instructional materials and media is presented in three chapters, including chapter 1, 2 and 9. In chapter 1, *Medium: companion or slave?*, Andrew Wright discusses the potential use of media and materials available in teachers' environments. He particularly aims to raise teachers' awareness of the creative use of their voice, body, pets, walls, school corridors, playground, papers and cards, and other things available to them. His thoughts presented in the chapter are really inspiring, especially for teachers who teach at schools with limited resources. Brian Tomlinson's ideas about how to use coursebooks creatively appear in chapter 2 and, in chapter 9, Kathleen M. Bailey and Anita Krishnan seem to add what Andrew Wright has explained in his chapter earlier. Specifically, they provide a number of "creative uses of images and objects by English teachers who have worked in under-resourced areas" (p. 84).

In summary, the book has drawn an interconnection between the ability to think creatively and problem-solving ability in order to define creativity in English language classroom contexts. What is interesting in the book is that it not only facilitates teachers' understanding of what creativity really is, why they need it and how to promote it in classroom practices, but it also helps teachers nurture and develop their own self-creativity and, of course, their students'. In addition, the ways that each of the authors presents their thoughts about creativity, the classroom procedures and potential resources for classroom activities are really impressive, they are logical, they use language that is familiar to the readers, which

makes them easy to follow. The book is worth reading for English teachers as it contributes to the area of ELT. The publication of the book has answered what teachers have been waiting for: creative language teaching approaches that can apply within different contexts.

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Book Review

Sociocultural Theory in Second Language Education: An Introduction through Narratives, by Merrill Swain, Penny Kinnear & Linda Steinman (2015, 2nd ed.). Multilingual Matters Textbooks, 192 pages, Paperback £19.95, Hardcover £69.95, ISBN: 978-1-78309-317-5.

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Vygotsky's sociocultural theory of mind (1978) highlights the interdependence of the individual, social community and interactions in the construction of knowledge. The theory has been widely adopted in the area of applied linguistics research, and it has been employed to explain second language learning processes (Storch, 2013). The stated aim of this 192-page book is to introduce the key concepts of sociocultural theory (SCT), including mediation, zone of proximal development, collaborative dialogue, private speech, everyday and scientific concepts, the interrelatedness of cognition and emotion, activity theory and assessments. As is posed on the cover of the book, these key notions of SCT are illuminated within the narratives to which the authors, Merrill Swain, Penny Kinnear and Linda Steinman**,** link various contexts of second language learning, teaching, testing, and research. Although major concepts discussed in the book originate from its first publication, this second edition provides the readers with more recent studies on Vygotskian SCT in second language education. The authors have also completed the book with references from all of Vygotsky's collected works that appear in the bibliography.

Sociocultural theory in second language education: An introduction through narratives, comprises eight chapters which follow a brief introduction from the authors. The book, in some respects, may be regarded as a narrative because the authors occupy all the eight chapters with stories related to language teaching and learning. In total, there are ten stories presented within the eight chapters. The authors purposefully employed these ten stories to illustrate one or more concepts of SCT and to create engagement between the theory and its classroom practice. The characteristics and context of the story are also presented by the authors to help readers follow the discussion and build a connection between SCT concepts and language learning practice. At the beginning of each story, the key principles of SCT and the working terminologies are briefly introduced to maintain the readers' focus

when reading. The authors' in-depth evaluation and relevant research related to the topic appear after the story and discussion questions are posed to readers to evaluate their understanding of the SCT concepts and their criticality. More importantly, the authors remind readers that the stories themselves are not the primary units of analysis in the book (p. xiii); nonetheless, they serve the SCT concepts which are so. Finally, a discussion is presented to the readers after the main chapters in order to review the concepts of Vygotsky's sociocultural theory they are already familiar with.

The first chapter *Mona: Across time and geography* illustrates the SCT tenets related to mediation. In Vygotsky's SCT, all forms of human higher mental (cognitive and emotional) activity are mediated by material and/or symbolic means (also known as artefacts). Within the chapter, mediation is explained as "the process which connects social and individual" (p.149). Mediational means refer to tools that individuals use to achieve their interactional goals. Through Mona's narrative, the authors highlight several mediational means that Mona used to attain her English learning goals, including grammar books, computers, English language lessons played on the radio and TV, tapes, her first language, and her social interactions. This book provides valuable insight for classroom language teachers to consider any classroom resources that may potentially mediate pupils' learning activity and teachers' instructional goals.

The concept of the zone of proximal development (ZPD) is demonstrated in chapter two, *Madame Tremblay: A French immersion story*. Madame Tremblay, a story written by Sarah who attended primary education in a Canadian French immersion program, resonates a number of interactions that enable learners to accomplish more than he/she could have accomplished if working alone; what is known as the ZPD. It is interesting that the authors perceive ZPD as a collaborative and dialogic interaction rather than a metaphor as ascribed by John-Steiner and Mahn (1996). The authors' argument that ZPD is an activity primarily relies on their grammatical and lexical interpretation of the term. In addition to the authors' attempt to define ZPD, they take issue with what is called intersubjectivity within the ZPD. The authors argue that a ZPD involves a number of individuals and thus suggests co-authorship or co-construction. To provide readers with clearer analysis of the *Madame Tremblay* narrative, the authors discuss two other related social theories, including scaffolding and community of practice (CoP).

Chapter three presents two narratives, namely *Jody (talking to self)* and *Sophie and Rachel (talking to others and self)*. However, the two narratives elaborate one same concept

of SCT, being that of languaging. From the two narratives, the authors show how languaging plays a salient role in promoting individuals' thinking processes. In Jody's narrative, the authors demonstrate the process of internalising language aspects through self-talk whilst in Sophie's and Rachel's, the authors suggest the role of collaborative dialogue in language learning. In spite of the authors' presentation of the two types of languaging (i.e private speech/self-talk, and collaborative dialogue), they contend that the use of the two terms appears to be interchangeable. The authors write, "what looks like collaborative dialogue may on closer inspection also be considered as speech for the self" (p. 32).

Thaya's narrative depicting Vygotsky' concepts of scientific (conscious, systematic) and everyday (spontaneous) language and their interconnection is the topic of chapter four (*Thaya: Writing across languages*). Contextualised in a writing classroom at the University of Ontario, the narrative is employed to illustrate "how students, especially Thaya, move between their everyday and scientific concepts to build their writing skills and sensibilities as well as a more conscious understanding of the writing process" (p. 50). To this end, the authors distinguish between Vygotsky's concepts of scientific (conscious, systematic) and everyday (spontaneous) language and evaluate the implications of these concepts when applied into language teaching and learning classroom practice.

In chapter five, entitled *Grace: The effect of affect*, the authors discuss the SCT concept of affect by demonstrating the interrelatedness of cognition and emotion in a learning process. From a SCT perspective, the involvement of acting, thinking and feeling is critical mainly when learning in the ZPD because not only does it suggest participation, but it also transforms learners' identity (Wells, 1999). Drawing upon Grace's narrative, the authors argue that thinking (cognition) and feeling (emotion) are inherently related and separating the two may limit individuals' complete understanding of their learning. To support this argument, the authors provide some evidence from research regarding the role of emotion in classroom language learning. Additionally, two other relevant concepts, including identity and regulation, are discussed to help readers better understand the concept of 'affect' and its value in language learning.

Sandra's narrative illustrates the key SCTs concept related to activity theory and it is presented in chapter six, entitled *Sandra's story: A teacher's dilemma.* Within the chapter, the authors present an activity theory perspective, claiming that human construction of knowledge is a physically and socially motivated activity. The focus of activity theory, as the authors argue, is on "the interaction of multiple individual and social forces rather than on an

individual" (p. 96). At this point, the authors evaluate Sandra's (teacher) and Marc's (student) email exchange and they reflect three primary elements in an activity system, namely subject (agent), object (goals) and mediational means. Sandra's tension within herself regarding her role and objectives during the many interaction between herself and her student is also illustrated to clarify the interconnectedness of the three elements. Of the complex networks within an activity system, the authors emphasise the rules (e.g. level of formality, languages), community and division of labour. At the end of the authors' discussion, they raise controversies related to the activity theory and challenge for the reconceptualisation of the relationship among learning, the individual and the context in order to suggest a view of learning for language teachers and scholars.

Chapter seven – *Yang: Being assessed* – recounts Yang' story in preparing a high-stakes exit test after attending an Academic Preparation Program at a Canadian university. Within the context of an English for academic purposes speaking course in Canada, the story exemplifies the potential contribution of SCT for second/foreign language assessment. Assessment itself is viewed as the process of documenting students' language learning, and its practice is a social and cultural activity. The authors argue that assessments "reflect the values and belief of the broader society in which they are developed and used" (p. 121). A debate about dynamic assessment is briefly presented as it has been considered for second language assessment. To this end, the authors discuss the story with a focus on second and foreign language testing as a mediated, goal-driven activity with social and educational implications.

The final chapter (chapter eight), entitled *Maria and the Beatles; Jean-Paul and Second life,* presents additional narratives from Maria and Jean-Paul. The first story of Maria presents a dialogue between two teachers who look to the Beatles for inspiration. The other, Jean-Paul's story, moves the discussion from the traditional classroom into a digital environment, specifically Second Life. In this chapter, the authors attempt to engage readers with the process of trying to understand the situation through SCT principles. Readers are given an opportunity to consider and evaluate the two additional narratives with the SCT concepts they already comprehend.

Overall, this second edition of *Sociocultural theory in second language education: An introduction through narratives,* is an exceptional discussion of SCT concepts that serves readers with an accessible entry to complex principles of Vygotsky. Despite the fact that the title of each chapter appears to drive attention towards one concept of SCT, the authors exceptionally establish the interrelatedness of Vygotsky's principles so that readers may gain

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Using Technology in Foreign Language Teaching (Book Review)

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Book Details:

Using Technology in Foreign Language Teaching, Edited by Rahma Al-Mahrooqi & Salah Troudi (2014). Cambridge Scholars Publishing, 320 pages, Hardcover £52.99, ISBN: 978-1-4438-6522-7.

The integration of information and communication technology (ICT) into foreign language (FL) learning classroom not only suggests learners' positive attitude towards learning (e.g. see Li, Chu, & Ki, 2014) but also transform the language learning and literacy acquisition atmosphere as well as the dynamic of language learning settings (Young, 2003). The book entitled *Using Technology in Foreign Language Learning* aims to explore underwhich conditions technologies used in the learning environment can best be utilized. To achieve this objective, this 13-chapter book with an introductory chapter by the book editors examines the ICT integration into FL classroom learning from the perspectives of actual users and professionals from different countries namely the United Arab Emirates, Saudi Arabia, Oman, Iran, and Malaysia. Six main issues are addressed in this edited volume including (1) the principled approach to integrating technology into course design, (2) approaches to the evaluation of computer-assisted language learning software (CALL) software, (3) the practice of blended learning, (4) teachers' view on technology integration, ICT knowledge and computer skills, (5) the practice of online learning in FL classroom setting, and finaly (5) the use of digital application, and Theories on integrating technology into language teaching practice are also discussed along with a brief summary of each chapter. Readers could benefit from this provision that they can choose which of the chapters may meet their needs and conditions. It is interesting that the book chapters are predominated by a number of studies that were conducted in diverse educational settings and employed using a variety of research methodologies. Moreover, pedagogical implications from the study are presented at the final section of each book chapter. It is therefore, as the editors argue, the book may provide evidence and suggest valuable insights for FL professionals, researchers as well as postgraduate students specifically regarding the ICT integration into FL classroom settings.

In the introductory chapter, the editors, Al-Mahrooqi and Troudi, provide a brief history of computer technology in language learning setting, its advantages as well as challenges that teachers may encounter when incorporating technology in classroom teaching practice. The editors also emphasise some crucial requirements that an FL institution have to meet for incorporating technology such as a solid infrastructure, teachers' and students' attitude towards computer and their computer skills.

A synthesis of relevant literature on approaches for technology integration is discussed in two chapters: chapter 1 and chapter 13. Chapter 1 *Blended learning in EFL: Adopting a principled approach to integrating technology,* authored by Claire Whittaker, focuses on a principled approach for technology integration within a blended learning environment. Whittaker's

discussion in chapter one might be considered as both a short summary and improvement of her early works which appeared in Tomlinson and Whittaker (2013). Only in this chapter, she promotes her thoughts on "how to achieve the principled approach to integrating technology into courses by determining the degree of overlap, the drawbacks and suggesting how we can proceed from this point" (p.8). Whittaker perceives the principled approach as "a systematic approach to the design process that is driven by pedagogy, that adds value to learning, and that is underpinned by language learning theory" (p.9). In order to attain a principled approach for technology integration into a blended language learning course design, Whittaker evaluates various framework and principles. What fundamental from the chapter is that the frameworks and principles addressed by the author seems to fit Reem Al Elbaikan and Salah Troudi's and Richard Peel' research that appear respectively in chapter 2 and 7. Those who are newcomers in incorporating technology within the field of foreign language teaching and learning, thus, will find this chapter beneficial as it also explores the shift of paradigm emphasizing "how various technology can be employed in language teaching to giving pedagogy a central role and organizing activities in the areas of language learning" (p.8).

Review of related literature for technology integration is also discussed in chapter 13 entitled *Approaches to the evaluation of computer-assisted language learning software*. In the chapter, the authors, Vahid Nimehchisalem and Jayakaran Mukundan attempt to seek a proper method for CALL software development and evaluation. They examine the various evaluative criteria and/or instruments suggested by ELT scholars for software evaluation (p. 286). Nimehchisalem and Mukundan argue that the recent frameworks available in CALL literature do not suggest a balanced representation of technical and pedagogical aspects required when evaluating CALL software. For example, the evaluation framework provided by software companies does not satisfactorily address the language skills while the instruments developed by ELT scholars pay much attention to the skills and less focus on technical features in the survey questions. Alternatively, they suggest the need for "a balanced focus on both predictive (before use) and retrospective (while or after use) CALL software evaluation" (p. 298).

The rest of the chapters in this edited volume report eleven studies from two different settings: blended learning environment and online learning setting. Two research reports on the practice of blended learning within FL classroom setting are presented in chapter 2 *Blended learning in Saudi Arabia: Potential for its use in EFL at the tertiary level* and in chapter 7 *Challenge and change in online reading: Learners' perception of textbooks and reading online*. In chapter 2, the authors, Ebaikan and Troudi, discuss their study on the potentials of adopting blended learning for EFL teaching and learning in Saudi Arabia. The study is interesting as its findings provide "insights into blended learning's potential for the teaching especially women in Saudi context" (p. 31). The authors believe that blended learning may increase the effectiveness of learning processes regarding the Saudi's culture that segregate sexes in all aspects of life including education (p. 37). Chapter 7 reports Richards Peel's study exploring the use of textbooks and reading online in the blended learning environment in the United Arab Emirates (UEA) context. While in the chapter two the emphasis is on "the essential role of the face-to-face element of blended courses" (p. 30), in this chapter seven, Peel attempts to examine learners' perceptions of the use of traditional textbooks and online reading (via the Internet and through programmes such as BlackBoard Vista [BBV]). The finding is quite surprising as it suggests that the online reading is less popular despite students' positive perception of the usefulness of online reading course (see p. 148). Some plausible factors that contribute to the findings as identified by the author include generational differences (digital natives, digital immigrants, and digital illiterates), learning style preference, learner types (visual learners, auditory learners, kinesthetic learners and read-write learners).

The practices of online learning in FL classroom setting are presented in seven chapters: chapter 3, 4, 5, 6, 8, 9 and 12. Chapter 3 entitled *Self-access or access to self?: Experimenting with e-*

learning in Oman presents a fundamental view on learner autonomy and learner independence. The authors, Alina Rebecca Chirciu and Tulika Mishra examine "the relationship between self-access learning and self-directed learning in English language education in Oman, by presenting the case of a higher education institution and its implementation of an e-learning platform" (p. 45). The finding of their study suggests that teachers' motivation and autonomy correlate with student motivation and autonomy. Chirciu and Mirsha write, "Student motivation to engage in self-access is directly proportional to the teachers' motivation to engage in it too" (p. 55). Chapter 4 *Integrating information and communication technology (ICT) into EFL classroom practice at Majma'ah university* and chapter 5 *Critical approach to integrating ICT into second language learning* follow up the view presented earlier in chapter 3 by demonstrating teachers' perspective of technology integration, ICT knowledge and skills. Teachers' use of ICT is also accounted within these two chapters.

In chapter 6 entitled *IT and L2 writing skills: EFL students' perceptions of e-feedback on their essays*, the authors, Susan Riley and Alireza Zareekbatani address two issues: (a) the advantages as well as the limitations of the use of information and communication technology (ICT) application in corrective feedback provision, and (b) L2 learners' perspectives on using e-feedback to reduce their local and global mistakes (p. 106). Chapter 8 *The internet chat room: A tool for promoting learner autonomy* reports Jo Mynard and Salah Troudi's study that examined ten new students' autonomous language learning when participating in a classroom-based chat room. Mynard and Troudi highlight some factors that suggest students' engagement with the learning activity enhanced by technology including students' motivation, individualised learning opportunity, design of the task, interaction, the effect of virtual learning environment. Kirsten Gear' study that is presented in chapter 9 *The self access centre WebQuest* still makes an issue related to learning autonomy. In her study, Gear focuses on promoting authentic materials as well as learner' learning independence through the use of WebQuest. She applied a constructivist-based student centred learning (SCL) platform in order to develop student-centered EFL and ESP WebQuests. In chapter 12 entitled *Online language corpora: Implications for EFL teaching*, Shaimaa Abd El Fattah Torky emphasises on the potential use of online language corpora for EFL learning. She evaluates "the practical implications of integrating corpus consultation into the EFL learning environment" (p. 253). Torky suggests an eclectic method to respond challenges in incorporating online language corpora into EFL classrooms.

The use of digital application in classroom setting is presented in two chapters. Al-Mahrooqi and Naqvi's study on ICT integration into digital video project-based instruction appears in chapter 10 entitled *Fostering EFL students' language development via student-created digital videos*. The result of their study shows that students positively perceived the ICT integration into their digital video project based learning activity. More importantly, the study revealed students' improvement on their vocabulary, reading and oral written communication ability. In addition to Al-Mahrooqi and Naqvi, Sandhya Rao Mehta explores the potential use of digital literatures in ELT and their discussion appear in chapter 11 *Is small really beautiful? Exploring digital literatures and their relevance to English language teaching (ELT).*

Overall, the book provides a comprehensive discussion in the area of CALL, specifically the practices of blended learning and online learning. The focus on learning autonomy and motivation which is promoted throughout the pracitice of blended learning and online learning is deliberately maintained by almost all the authors in the book. The fact that the book is composed by actual users and professionals and their writing is based upon academic research suggests evidence-based exploration of blended and online learning within EFL classroom environments. The contexts provided in this book are limited to higher education institutions within Arab countries. This may explain why gender issues in FL classroom is so concerned in the book and are successfully addressed by some of the authors.

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Book Review

Sociocultural Theory in Second Language Education: An Introduction through Narratives, by Merrill Swain, Penny Kinnear & Linda Steinman (2015, 2nd ed.). Multilingual Matters Textbooks, 192 pages, Paperback £19.95, Hardcover £69.95, ISBN: 978-1-78309-317-5.

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Vygotsky's sociocultural theory of mind (1978) highlights the interdependence of the individual, social community and interactions in the construction of knowledge. The theory has been widely adopted in the area of applied linguistics research, and it has been employed to explain second language learning processes (Storch, 2013). The stated aim of this 192-page book is to introduce the key concepts of sociocultural theory (SCT), including mediation, zone of proximal development, collaborative dialogue, private speech, everyday and scientific concepts, the interrelatedness of cognition and emotion, activity theory and assessments. As is posed on the cover of the book, these key notions of SCT are illuminated within the narratives to which the authors, Merrill Swain, Penny Kinnear and Linda Steinman**,** link various contexts of second language learning, teaching, testing, and research. Although major concepts discussed in the book originate from its first publication, this second edition provides the readers with more recent studies on Vygotskian SCT in second language education. The authors have also completed the book with references from all of Vygotsky's collected works that appear in the bibliography.

Sociocultural theory in second language education: An introduction through narratives, comprises eight chapters which follow a brief introduction from the authors. The book, in some respects, may be regarded as a narrative because the authors occupy all the eight chapters with stories related to language teaching and learning. In total, there are ten stories presented within the eight chapters. The authors purposefully employed these ten stories to illustrate one or more concepts of SCT and to create engagement between the theory and its classroom practice. The characteristics and context of the story are also presented by the authors to help readers follow the discussion and build a connection between SCT concepts and language learning practice. At the beginning of each story, the key principles of SCT and the working terminologies are briefly introduced to maintain the readers' focus

when reading. The authors' in-depth evaluation and relevant research related to the topic appear after the story and discussion questions are posed to readers to evaluate their understanding of the SCT concepts and their criticality. More importantly, the authors remind readers that the stories themselves are not the primary units of analysis in the book (p. xiii); nonetheless, they serve the SCT concepts which are so. Finally, a discussion is presented to the readers after the main chapters in order to review the concepts of Vygotsky's sociocultural theory they are already familiar with.

The first chapter *Mona: Across time and geography* illustrates the SCT tenets related to mediation. In Vygotsky's SCT, all forms of human higher mental (cognitive and emotional) activity are mediated by material and/or symbolic means (also known as artefacts). Within the chapter, mediation is explained as "the process which connects social and individual" (p.149). Mediational means refer to tools that individuals use to achieve their interactional goals. Through Mona's narrative, the authors highlight several mediational means that Mona used to attain her English learning goals, including grammar books, computers, English language lessons played on the radio and TV, tapes, her first language, and her social interactions. This book provides valuable insight for classroom language teachers to consider any classroom resources that may potentially mediate pupils' learning activity and teachers' instructional goals.

The concept of the zone of proximal development (ZPD) is demonstrated in chapter two, *Madame Tremblay: A French immersion story*. Madame Tremblay, a story written by Sarah who attended primary education in a Canadian French immersion program, resonates a number of interactions that enable learners to accomplish more than he/she could have accomplished if working alone; what is known as the ZPD. It is interesting that the authors perceive ZPD as a collaborative and dialogic interaction rather than a metaphor as ascribed by John-Steiner and Mahn (1996). The authors' argument that ZPD is an activity primarily relies on their grammatical and lexical interpretation of the term. In addition to the authors' attempt to define ZPD, they take issue with what is called intersubjectivity within the ZPD. The authors argue that a ZPD involves a number of individuals and thus suggests co-authorship or co-construction. To provide readers with clearer analysis of the *Madame Tremblay* narrative, the authors discuss two other related social theories, including scaffolding and community of practice (CoP).

Chapter three presents two narratives, namely *Jody (talking to self)* and *Sophie and Rachel (talking to others and self)*. However, the two narratives elaborate one same concept

of SCT, being that of languaging. From the two narratives, the authors show how languaging plays a salient role in promoting individuals' thinking processes. In Jody's narrative, the authors demonstrate the process of internalising language aspects through self-talk whilst in Sophie's and Rachel's, the authors suggest the role of collaborative dialogue in language learning. In spite of the authors' presentation of the two types of languaging (i.e private speech/self-talk, and collaborative dialogue), they contend that the use of the two terms appears to be interchangeable. The authors write, "what looks like collaborative dialogue may on closer inspection also be considered as speech for the self" (p. 32).

Thaya's narrative depicting Vygotsky' concepts of scientific (conscious, systematic) and everyday (spontaneous) language and their interconnection is the topic of chapter four (*Thaya: Writing across languages*). Contextualised in a writing classroom at the University of Ontario, the narrative is employed to illustrate "how students, especially Thaya, move between their everyday and scientific concepts to build their writing skills and sensibilities as well as a more conscious understanding of the writing process" (p. 50). To this end, the authors distinguish between Vygotsky's concepts of scientific (conscious, systematic) and everyday (spontaneous) language and evaluate the implications of these concepts when applied into language teaching and learning classroom practice.

In chapter five, entitled *Grace: The effect of affect*, the authors discuss the SCT concept of affect by demonstrating the interrelatedness of cognition and emotion in a learning process. From a SCT perspective, the involvement of acting, thinking and feeling is critical mainly when learning in the ZPD because not only does it suggest participation, but it also transforms learners' identity (Wells, 1999). Drawing upon Grace's narrative, the authors argue that thinking (cognition) and feeling (emotion) are inherently related and separating the two may limit individuals' complete understanding of their learning. To support this argument, the authors provide some evidence from research regarding the role of emotion in classroom language learning. Additionally, two other relevant concepts, including identity and regulation, are discussed to help readers better understand the concept of 'affect' and its value in language learning.

Sandra's narrative illustrates the key SCTs concept related to activity theory and it is presented in chapter six, entitled *Sandra's story: A teacher's dilemma.* Within the chapter, the authors present an activity theory perspective, claiming that human construction of knowledge is a physically and socially motivated activity. The focus of activity theory, as the authors argue, is on "the interaction of multiple individual and social forces rather than on an

individual" (p. 96). At this point, the authors evaluate Sandra's (teacher) and Marc's (student) email exchange and they reflect three primary elements in an activity system, namely subject (agent), object (goals) and mediational means. Sandra's tension within herself regarding her role and objectives during the many interaction between herself and her student is also illustrated to clarify the interconnectedness of the three elements. Of the complex networks within an activity system, the authors emphasise the rules (e.g. level of formality, languages), community and division of labour. At the end of the authors' discussion, they raise controversies related to the activity theory and challenge for the reconceptualisation of the relationship among learning, the individual and the context in order to suggest a view of learning for language teachers and scholars.

Chapter seven – *Yang: Being assessed* – recounts Yang' story in preparing a high-stakes exit test after attending an Academic Preparation Program at a Canadian university. Within the context of an English for academic purposes speaking course in Canada, the story exemplifies the potential contribution of SCT for second/foreign language assessment. Assessment itself is viewed as the process of documenting students' language learning, and its practice is a social and cultural activity. The authors argue that assessments "reflect the values and belief of the broader society in which they are developed and used" (p. 121). A debate about dynamic assessment is briefly presented as it has been considered for second language assessment. To this end, the authors discuss the story with a focus on second and foreign language testing as a mediated, goal-driven activity with social and educational implications.

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The practices of online learning in FL classroom setting are presented in seven chapters: chapter 3, 4, 5, 6, 8, 9 and 12. Chapter 3 entitled *Self-access or access to self?: Experimenting with e-*

learning in Oman presents a fundamental view on learner autonomy and learner independence. The authors, Alina Rebecca Chirciu and Tulika Mishra examine "the relationship between self-access learning and self-directed learning in English language education in Oman, by presenting the case of a higher education institution and its implementation of an e-learning platform" (p. 45). The finding of their study suggests that teachers' motivation and autonomy correlate with student motivation and autonomy. Chirciu and Mirsha write, "Student motivation to engage in self-access is directly proportional to the teachers' motivation to engage in it too" (p. 55). Chapter 4 *Integrating information and communication technology (ICT) into EFL classroom practice at Majma'ah university* and chapter 5 *Critical approach to integrating ICT into second language learning* follow up the view presented earlier in chapter 3 by demonstrating teachers' perspective of technology integration, ICT knowledge and skills. Teachers' use of ICT is also accounted within these two chapters.

In chapter 6 entitled *IT and L2 writing skills: EFL students' perceptions of e-feedback on their essays*, the authors, Susan Riley and Alireza Zareekbatani address two issues: (a) the advantages as well as the limitations of the use of information and communication technology (ICT) application in corrective feedback provision, and (b) L2 learners' perspectives on using e-feedback to reduce their local and global mistakes (p. 106). Chapter 8 *The internet chat room: A tool for promoting learner autonomy* reports Jo Mynard and Salah Troudi's study that examined ten new students' autonomous language learning when participating in a classroom-based chat room. Mynard and Troudi highlight some factors that suggest students' engagement with the learning activity enhanced by technology including students' motivation, individualised learning opportunity, design of the task, interaction, the effect of virtual learning environment. Kirsten Gear' study that is presented in chapter 9 *The self access centre WebQuest* still makes an issue related to learning autonomy. In her study, Gear focuses on promoting authentic materials as well as learner' learning independence through the use of WebQuest. She applied a constructivist-based student centred learning (SCL) platform in order to develop student-centered EFL and ESP WebQuests. In chapter 12 entitled *Online language corpora: Implications for EFL teaching*, Shaimaa Abd El Fattah Torky emphasises on the potential use of online language corpora for EFL learning. She evaluates "the practical implications of integrating corpus consultation into the EFL learning environment" (p. 253). Torky suggests an eclectic method to respond challenges in incorporating online language corpora into EFL classrooms.

The use of digital application in classroom setting is presented in two chapters. Al-Mahrooqi and Naqvi's study on ICT integration into digital video project-based instruction appears in chapter 10 entitled *Fostering EFL students' language development via student-created digital videos*. The result of their study shows that students positively perceived the ICT integration into their digital video project based learning activity. More importantly, the study revealed students' improvement on their vocabulary, reading and oral written communication ability. In addition to Al-Mahrooqi and Naqvi, Sandhya Rao Mehta explores the potential use of digital literatures in ELT and their discussion appear in chapter 11 *Is small really beautiful? Exploring digital literatures and their relevance to English language teaching (ELT).*

Overall, the book provides a comprehensive discussion in the area of CALL, specifically the practices of blended learning and online learning. The focus on learning autonomy and motivation which is promoted throughout the pracitice of blended learning and online learning is deliberately maintained by almost all the authors in the book. The fact that the book is composed by actual users and professionals and their writing is based upon academic research suggests evidence-based exploration of blended and online learning within EFL classroom environments. The contexts provided in this book are limited to higher education institutions within Arab countries. This may explain why gender issues in FL classroom is so concerned in the book and are successfully addressed by some of the authors.

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Aisyiyah Organization and Social Change for Women

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Abstract
The rise of Indonesian women cannot be separated from the role of Aisyiyah organization since it was established in 1917. The examples are in education, social, religious, charity and society for more than four thousands of Aisyiyah Bustanul Afthal Kindergarten, big hospitals, health business such as mother children health, economic activities, the orphanage, women documents mainly Aisyiyah about women who have to struggle and have activity in the society. The documents such as books of " A guidance to be a meaningful wife in Islam", "Adabul Marah fil Islam", " A guidance to be harmonious family" and "The relation of men and women in Muhammadiyah".Something interesting that the book of "A guidance to be harmonious family" becomes the reference for Family Planning Department to support government program in forming the prosperity family. From the facts above, it can be concluded that Aisyiyah has positive contribution for Indonesian and women to develop their own potential optimally in accordance with the role that want to be implemented in the society.
Keywords: Aisyiyah Women Organization, Activities on Education, Health, and Social Change for Women.

1. Introduction

The role of Indonesian women in the society has a long history. It is influenced by the condition of social and culture, tradition, politic, and religious understanding. When someone is born, whether men or women, it is start to learn the different role, in patriarchy culture, women as an object, women is hidden, previlage of women is lost systematically. (Arivia, 2006:40).

In Patriachy culture, men is assosiated with positive things such as active, sun, culture, day, writing, high. On the other hand, women is assosiated with negative things such as passive, moon, nature, oral, low. (Arivia, 2006:41). Patriarchal is a social system that places men as a main figure central in social organization, and implies the isntitutional government and men special rights and demands the women subordination (https://id.wikipedia.org/wiki/Patriarki).

The role is played by women in the domestic sphere or the public during this time is fully of interpretation, imagination, which is built, which is constructed, which is produced and reproduced by understanding that is created socially and culturally, and actors or social agents are men with various of social, religious, cultural, and economic, and politic. The patriarchy construction begins from those things, including the religious interpretation of hegemony and domination. (Abdullah, 2015:10).

Islam does not distinguish between women and men in the public sphere. The teachings of Islam does not separate between faith and good deeds, therefore, Islamic education is the education faith and charity. Because Islam contains teachings about personal attitudes and behavior of society towards the welfare of the individual and the group. Therefore, Islamic education is the education of individuals and public education.

The birth of Aisyiyah women organization was motivated by helpless women, there is a poor society, powerless of economic and social, in the environment of Kauman Yogyakarta. Syncretism that has distanced the values of the Qur'an and Sunnah, belief in superstition, heresy and superstition has blinded the truth of the Qur'an.

Aisyiyah organization as a supporting significant change to the big role of women that women become a part that cannot be separated from men to build jointly the society, and nation. Women become the family power to build a peaceful society, harmony, and blessed by God, "*baldatun toyyibatun gaffur*" society. For those reasons, women should be able to get out from curry ignorance and backwardness. Make women smart, intelligent, has the ability in preaching, has the ability to balance between religion and science knowledge, will benefit for the establishment of a harmonious family, harmonious family will born the amazing generations.

Education will direct man not only has the ability to adapt to the environment, but can reconstruct, even deconstruct it, thus allowing humans to live in a democratic social order, to provide equal opportunities for everyone without exception, men and women. Thus, when the women and men potentials are together to build the strength, it would create a powerful energy to build a great society.

Almost one hundred years, Aisyiyah (1917 – 2016) in Indonesia, has many activities performed although at the beginning of the activities is seen "simple" but in substance is opened the women mind which cause the enlightenment tremendous impact. "Renewal of the education done by Kyai H.A. Dahlan has spawned breakthrough the modern Islamic education system that is holistic or integrative ". (Nasir, 2010:125).

Nowadays, the equality, gender equity has become a universal claim. This is due to the gender gap is not just a local issue, regional or national, but also international issues. The demands of the role of equality between men and women (gender equality) is often expressed by women and men as the fighters gender, as an attempt to

gain a chance to succeed in social life, national and state.

Since 1917, Aisyiyah have to appreciate the view of justice and gender equality. In the development, the terms of activity to respond the changes continue to a better direction, Aisyiyah helped move actively contribute the ideas and concrete action in establishing the women equality as evidence shown in the important documents such as Aisyiyah which shows the contribution to the social changes of Indonesian women. Since 1917, Aisyiyah has come out of the negative labeling of women. Through education organizations, Asiyiyah has done for women to participate in the society, as is often asserted by Kyai H. A. Dahlan "That should not take the kitchen affairs obstacle to running the task in the face of society" (Nasir, 2010:369).

Associated with it, then this article will elaborate on the organization "Aisyiyah and social change for women, how Aisyiyah through educational and social areas of religious and social role in giving the enlightenment, while contributing positively elevate the role and opportunities of women and men to fighting together for the nation and the state.

1.1 Research Objectives

In general, this study aims to formulate the history of Aisyiyah organization in charitable efforts in education, and to analyze the movement of Aisyiyah organization in fighting for women's rights in addition to explore Aisyiyah organization as an organization of Indonesian women who have concern for the education sector as a means of people progress, namely education for all people, education based Islam, equality-based oriented to the future, progress and civilized.

1.2 Research Questions

a. How the Aisyiyah organization formulate the basic education as a renewal movement?
b. What are the women rights that want to achieved by Aisyiyah organization?
c. What values that can be given by Aisyiyah for the progress of Indonesia?

2. Methodology

This research was conducted with a qualitative approach using case study method. Case study is defined as a method of qualitative research reveals certain cases. Subject of this research is the organization staffs and the charitable efforts of education. Research conducted in Aisyiyah Bustanul Afthal Kindergarten, on Gondomanan Street Yogyakarta, and in Aisyiyah University Yogyakarta on Diploma of Midwifery Study Program.

Data collection technique was collected through participant observation, interviews, document analysis and triangulation. Data analysis techniques used a technique which is presented by Miles & Hubermas (1992:16-19), namely: 1) data reduction; 2) data display; and, 3) conclusion or verification.

3. The Research Result

Several activities has been made by Aisyiyah organization since it was established in 1917, the pioneering K.H. A. Dahlan had changed the situation of Muslims, the activity is the purification of religious, charity on social and religious, awareness of the knowledge and education to rise the women position, breakthroughs in the field of modern education in an integrated manner, from a simple thing but very amazing at the moment.

Aisyiyah organization has already aware of gender in Indonesia since 1912, when the Indonesian society is still backward, still alive with the tradition of thick patriarchy, all women are still in the kitchen, but Muhammadiyah, has brought women out, society, teach the Al Qur'an, studying Al Quran, learned to read Latin, KH A Dahlan said "do not you bothered by the kitchen affairs", this shows, the demolition of a thought, meaning that women must think of preaching, society, equal to men.

Muhammadiyah is a pioneer organization in the field of education, to teach women who are still illiterate in latin, nor the Quran, women are invited out of the habit of tradition of Kauman to do the preaching, teaching women to be smart. Aisyiyah build the awareness of all the parties to intelligently, updates accomplishments, education that is not commonly done in that time, which integrates the religion science with general science, integrates the religion values in public education; develop the public education system in Muhamamdiyah schools.

The views that men and women are equal, the same mental, but physically are different. Women, when given the opportunity able to reach a huge potential, because the essence of God according to the women and men were not different from anything except the faithful. Aisyiyah in education charity efforts to integrate the religious education and general science and build a strong personality or character and berkemajuan through the school system forms an integrated Islamic education (integrative) even holistic (comprehensive). The spirit and the efforts to realize the Aisyiyah achievement to educate the children of the nation's, men and women to reach citizens who are responsible and capable of being part of a good citizen, ready to face society changes fastly, to be a society that want to be achieved "baldatun toyyibatun wa rabbun gaffur (your nation is a a good and comfort nation, while the God is a merciful God (Q. Surat Saba, verse 15).

Documents that are created are important documents about the role of the woman in question is the first

guidance document " Achieving Meaningful Muslim Wife", the second is a treatise of Adabul Mar'ah fil Islam, and the third is "Guidance to be Harmonious Family, "Relation Fiqh between men and women".

4. The Discussion of Research Result

Muhammadiyah women's organization namely 'Aisyiyah, established by Muhammadiyah, on May 19, 1917. Day by day, since congress in 2005 became an autonomous organization specifically from Muhammadiyah, it means that all members are members of Muhammadiyah which given the authorized to organizes the charitable efforts established by the leader of Muhammadiyah in coordination element with the head assistant in charge in accordance with the applicable provisions of the charitable efforts of it (Article 5, paragraph 2, AD / ART Aisyiyah,:6). Aisyiyah is a socio-religious organization which has grown into a modern woman's organizations, the movements in the fields of education, health, social, characterized by strongly religious activities.

Kyai A. Dahlan teaches Aisyiyah, then it implemented in addressing the modern problems. His opinion, Islam is directed to the changes, the teachings of Islam which is ideal to be able to move people to change from anguish, sorrow to happiness and progress. Abdurrahman stated that: "The history of a people will only be changed by God if there is the will and an effort of all segments of the clan themselves and the transformation is basically changing the life history of a society to be participative, open and emancipate "(Rahman, 1995:140).

Since 1917, Kyai and Nyai A. A. Dahlan Dahlan with full of sprit providing the valuable knowledge and learning. One of the things they teach is analyzing the verses of the Qur'an related to society, such as the letter of Al Ma'un, Ali Imron 104, an Nahl 97. Another important point is the recommendation and to allow women outside the home for preaching business. The work is a proof of the spirit of change that was initiated and at the same time done by Kyai brings about change, and leads to a good direction.

The idea of other changes to continue what they have learned in the study, to be forwarded, taught to other women, so that other women also get the same knowledge. This is the beginning of the "*bimubalighot-mubalighot*" born in Muhammadiyah, The point of view of changes on women, that women can equally with men can work to progress and able to help improve the health, charitable and pious behavior can preach become a main attitude in developing Aisyiyah organization.

The basic foundation in implementing the Aisyiyah organization is acts of worship that must be accomplished, is struggling for the happiness and society prosperity. Acts of worship that is done are social, for and within Muhammadiyah is striving for goodness, happiness and human prosperity, as the completeness of deeds personally direct to God (Zamahsari, et al., 2011:83), as the starting point of the movement women in Muhammadiyah stems from the understanding of Islam with modernity approach (Muarif, 2011:15).

Aisyiyah activities continues to grow, education and learning continue to be done, until 1922, it is necessary to establish the mosque itself that serves as a gathering place for mothers to talk about various activities and activities of the organization. Aisyiyah mosque is a new place to accommodate Aisyiyah mothers in planning, carrying out the various activities of humanitarian action. In this mosque, the *"Taraweh*" prayers during the fasting month made specifically for women. Asiyiyah called by many observers as a reformist movement that has the characteristics of urban and rational (Kuntowijoyo, 1993:131-135), can be explained from a variety of activities, Aisyiyah how women can be preachers, able to give an opinion, informing the right thing, dare to act against things that are wrong along entirely devoted to devotion to God, the other is a woman can make a decision, can be a politician, certainly not to leave the unity, integrity and family welfare, organization, being a harmonious family through *qoriyah thoyyibah* activity, became " signs that women not only take care of herself "(Kuntowijoyo, 1993:133). So Aisyiyah has a lot of value that can be extracted and exemplary by the wider society in order to increase the better role of women.

An important document that is recorded is the first Islamic Guidance to Achieve Meaningful wife, it has twelve critical points (HB Majlis' Aisyiyah, 1939:19-36 in Gunawan, 2015:9), the author divided into the guidance ;1-9 are domestic points and 10-12 are public points as follows: 1) keep her husband's household; 2) make her husband happy; 3) obedience to the command of her husband; 4) keep the sanctity themselves and their households; 5) parenting (woman,) the children; 6) to help her husband in educating their children; 7) shut her nakedness; 8) does not act/inappropriate attitude; 9) do not get along with men of the opposite sex; 10) when traveling fulfill the decision of the Legal Affairs Committee; 11) stay at home and if the outside is not as women of ignorance; 12) do good to relatives, in-laws, and the waiter.

The second document is a treatise of Adabul Mar'ah fil Islam (Kuntowijoyo, 1993: 132; Ruhaini, 2015:8; Gunawan, 2015:10). Adabul Mara'ah fil Islam open access and participation of men and women progressively and positive about education, another important affirmation of the document as much as 99 pages related to women's rights, there is no problem anymore if women have the power to decide, especially when as a judge, director, village, district, ministers, mayors, regents, as part of the inheritors of the earth, active in politics, actively involved in the *Jihad* arena, contributing to the science field, work in the art field, may join the procession, marches, demonstrations, the social aspects of society is a balance between men and women (Ruhaini, 2015:8; Gunawan, 2015:10). Another important part of this document is publishing the principles of consensus, equality of men and

women; Islam gives equal rights for men and women, as well as an explanation that God would treat equally to men and women who have been responsible based on the charity.

The third document is formulated the guidance towards Harmonious family. This idea as a response to criticism of the changes in the ethos of the family, especially in urban metropolitan cities of Indonesia, industrialization and high-free life outside the family have threatened the unity of the family of workers which full of mobility (Kuntowijoyo, 1993:133). Understanding of Aisyiyah organization about family is the embodiment of fostering harmonious family, a family filled with love, respect and supports each other; in terms of religion has the power of faith and piety. Realization of a harmonious family believed would help implement the increased role of women in achieving prosperous families and society as a whole (Darban, (et al), 2010:173). Actually, to develop each family became a harmonious family is the fulfillment of the five basic elements of family life as follows: the establishment of religious life and *Ubudiyah* in the family, good family education, family health is assured, stable economy, and good relations of inter family members in the society (Darban, 2010:173).

Aisyiyah as a women's component of Muhammadiyah in creating a society that is equitable and gender justice, fight and respond to issues concerning women, even though at the beginning of its establishment in the field of education, but in its development struggle in another way such as to reduce poverty, unemployment, pornography, trafficking, health, prosperous, this is done in well-organized, well-programmed by utilizing the full potential of Aisyiyah. As the thinking guidelines contained in the fourth document is Muhammadiyah as a document of the fourth "Relationships fiqh men and women".

5. Conclusion

The struggle for equality and justice for women and men to participate in the society and the development of the country continues to be fought, by women and men, individually or in groups, by the community and government. All simultaneously together contribute according to their respective portions. Because the essence of men and women with the each capacity has a role and the same potential to play a role and contribute positively to the advancement of society and the nation.

Aisyiyah in the organization since it established in 1917 until today have contributed in various charitable efforts that the convening, education has been scattered throughout the country, thousands of educational pre-school, thousands of kindergartens, maternity hospital, economic activities, orphanages, and at this time has Aisyiyah University, the only one university run by women's organizations in Indonesia.

In the begining of Muhamamdiyah and Aisyiyah have "provocated" the establishment of modern education, holistic and integrated education, combining religious education and general science, even in the past is regarded as odd and even considered "infidels", but after a century is gone, now “modern " school is appeared, " integrated modern school "," Islam school".

Muhammadiyah and Aisyiyah have been made almost a century ago. Another concept to provide support to the role of mainly Indonesian women, Aisyiyah has made an official document as a reference ideological involvement of women in the society development, even if they should be criticized, but this effort to show concern and alignments. Asiyiyah on women's role in public space, the documents are a book of “Islamic guidance to be meaningful wife (1939), Adabul Mar'ah fil Islam (1972), “Guidance to be harmonious family (1989), the relationship of men and women in view of Muhammadiyah.

5.1 Academic Recommendation

Aisyiyah organization which has a century old had a long history with many heritages of the activities and thoughts, therefore:

a. For researchers who are interested in Aisyiyah organization can try other approaches and methods to be able to find a variety potential of Aisyiyah more detail.
b. Education which is held by Aisyiyah organization is holistically and integrally combines the general science and religion when a trend education in Indonesia with the title "Integrated Islam", "Modern School" etc., for researchers who are interested can perform comparative studies of public schools and integrated school, where lies the advantage between the two models of school, etc. For researchers who are interested can perform comparative studies of public schools and integrated school, where lies the advantage between the two models of school.

5.2 Practical Recommendation

a. It takes clearly idea to constantly reposition become “*Tajdid”* organization, reformer, not stuck with pride and routine care of the charitable efforts of an increasingly broad and large, because the challenge increasingly complex in the future and the quality of social issues is higher.
b. To the head of Aisyiyah organization from the center to the branch to keep working hard and earnest sincerity, not stuck with the routines and "carried away" by the amount of the charitable efforts of education which is continued and grow.

c. Experiences, dedication, sincerity, hard work, role model, are the example of the values of Islam has become a valuable character in Aisyiyah organization. It can be beneficial for educators to teach the character.

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ENHANCING OF STUDENTS' MATHEMATICAL REFLECTIVE THINKING ABILITY THROUGH KNOWLEDGE SHARING LEARNING STRATEGY IN SENIOR HIGH SCHOOL

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ABSTRACT

This study aims to find out enhancement of students' mathematical reflective thinking ability through knowledge sharing learning strategy in Senior High School. The method of study used quasi experiment by non-equivalent control group design. The population of this study are eighth grader students of Senior High School in Tangerang City, Banten Province. Sampling technique used cluster random sampling with the numbers of students are 140 students. The instruments used in the form prior mathematical knowledge test and mathematical reflective thinking ability test. Data analysis are done by requisite test, namely data normality test (Kolmogorov-Smirnov *Z* Test) and homogeneity test (Levene Test). The statistic analysis of the data was conducted with one-way ANOVA, two-way ANOVA, and Scheffe Test. The results of study are as follows: (1) there is enhancement difference of mathematical reflective thinking ability of the students learning with knowledge sharing strategy and conventional learning; (2) there is enhancement difference of mathematical reflective thinking ability between students learning with knowledge sharing strategy (KSS) and conventional learning based on school level and prior mathematical knowledge (MPK) of students (higher, middle, lower); (3) The interaction between learning strategy (KSS) and prior mathematical knowledge (higher, middle, lower) influenced student's enhancement of mathematical reflective thinking ability.

Keywords: Reflective Thinking Ability, Knowledge Sharing Strategy (KSS)

I. INTRODUCTION

Teacher should be careful in thinking about learning experience which rise higher mathematical thinking process for students' in mathematics learning. Schoenfeld (1985) described that activity which related with that higher mathematical ability comprise: search and explore pattern, understand structure and mathematical relation, use data, formulate and solve the problem, analogical reasoning, estimate, arrange rational reason, generalize, communicate mathematical ideas, and check the answer correctness. Students are demanded to be active in each learning activity in order that mathematical ability to be developed optimally.

The problems occured in school when teacher only give information and cannot provide much opportunity to students when deliver their idea in learning. This is result in students who considered that mathematics is very difficult and scarring, so they don't like even hate mathematics lesson. Mathematics learning is felt difficult, because loaded by formulations and learning strategy which is incorrect that make student feel uncomfortable during mathematics learning activity. Most of

students less understand mathematics concept given by teacher. Given that condition, finally students cannot concern with benefit of mathematics which is part of daily life.

Students should be able to see and experience themselves the usefulness of mathematics in real life, and give benefit of learning mathematics for other subjects. That habit can provide opportunity to students in order to speak, write the idea, give perception or reason in class. Perception or reason contains logical idea related with mathematics concept. According to Dewey (Che, 2008:6) that the goal of education is give contribution in personal and social development through experience and problem solving that take place reflectively (reflective thinking). Reflective thinking is a process which involves skill mentally in solving problem, identifying about everything have been known, doing understanding modification, and applying the result which is obtained in other situation. Sabandar (2009) reveal that critical thinking ability and creative thinking is coverage of reflective thinking ability.

Critical thinking ability became demand in KTSP or Curriculum 2013 which is now being applied in some schools. The result of study which was conducted by Harel & Sowder (2000), and Jacob & Sam (2008) showed that process of student's critical thinking is still categorized low and based on observation result toward teachers in teaching, often focus on the ways of understanding but cannot help students to build effective ways to think from the ways of understanding. The next result of study which was conducted by Noer (2010) to see student's reflective thinking ability, has an average is 31.43 with minimal value of 16 and maximal value of 52. This result showed that student's reflective mathematical thinking generally is still under 70% from ideal score. Then, mathematical reflective thinking ability which is still low reflected in introductory study which was conducted by Nindiasari (2010) in one of Senior High School in Tangerang Regency, Banten Province. Her observation result are: teacher in teaching not get used to develop student's thinking ability, teacher in giving ready to used formulations in explaining a mathematical concept, almost 60% student has not been able to achieve mathematical reflective thinking.

Mathematics learning in each school level has similarity in learning, that is still mechanistic, student less involved in learning process, less present various situation and problem, exercise items which is given by teacher often resemble example and routine. This situation have the impact on student's mindset which is underdeveloped in revealing idea or opinion, limitation of creativity not in accord with potency possessed. To omit negative impression, teacher should be clever to choose learning that introduce mathematics concept which effectively presented with daily life problem, that is with knowledge sharing learning strategy.

Knowledge sharing strategy is learning strategy which can strengthen, broaden, and apply knowledge, so capable to answer mathematics problem. Activity of knowledge sharing learning cannot be separated from prior mathematical knowledge (PMK) for students when sharing knowledge process occured. Students' prior knowledge will give contribution to knowledge quality which will be shared. Knowledge sharing strategy which is supported by prior mathematical knowledge in mathematical learning give opportunity to students to give reason in each step taken, by look back to what have been done, search strategy/solution to problem. It is hoped that students who follow knowledge sharing strategy can be developed well in evaluating what has been done when solving the problem faced.

II. THEORITICAL INQUIRY

1. Mathematical Reflective Thinking Ability

Reflective thinking in mathematics learning can create meaningful learning for students. John Dewey (1933) define reflective thinking are something which is done actively, persevering, and with full of consideration toward a belief which is supported by clear reason and can make conclusion/decide a solution to problem given. Students who has reflective thinking ability do learning activity independently based on logical reasons and proof in accord with what become demand of assumption in making conclusion. Through reflective thinking, students can always evaluate or think back what has been done. Evaluation process aim to search and decide solution taken in answering a problem in hand in order to obtain best solution.

Reflective thinking is self-regulation to generate interpretation until conclusion. Someone who used reflective thinking ability will has ability to identify the problem, choose alternative of solution or solution strategy to generate an interpretation to problem, analyze problem and evaluate solution, conclude and decide best solution to problems given.

Weast (1996) arrange list of mathematical reflective thinking ability as follow: (1) identify conclusion; (2) identify reason and proof; (3) identify confused and vague language; (4) identify valuable assumption and conflict; (5) identify descriptive assumptions; (6) evaluate statistic reasoning; (7) evaluate sampling and measurement; (8) evaluate logical reasoning; (9) identify information which is omitted; (10) articulate or define a value in thinking, the way of thinking which is full of consideration.

Student's reflective thinking ability can be developed through learning which involve students in finding a mathematics concept, so students have opportunity to explore the ability possessed through scaffolding which is done by teacher. In this study, mathematical reflective thinking ability is student's ability in understanding logical thinking process by looking back at what have been done then searching solution or answering a problem situation to achieve thinking level when solve the problems. Indicators of mathematical reflective thinking ability which are measured are: (1) Use various solution strategies, or give various examples statement related with certain mathematical concept; (2) Use relation/connection among mathematics topic; (3) Identify mathematic concept or formulation which is involved in mathematics problem which is not simple; (4) Evaluate/examine the correctness of argument/reason based on concept/nature of mathematics used; (5) Determine general rule/conclude from data presented and determine the correctness of conclusion and its reason.

2. Knowledge Sharing Strategy

Knowledge sharing strategy is often described as learning activity in the form of discussion of problems related to daily life. Each student becomes subject of investigation and reliable information resource based on reference. Diversity of learning sources and intellectual which is possessed by students become challenge for teacher in selecting information which is difficult to understand. Nutchey (2011) explicitly stated that knowledge sharing is capable to describe learning community and special understanding of each student. Teacher as facilitator should have sensitivity in observing smart student and help students' difficulties in knowledge sharing.

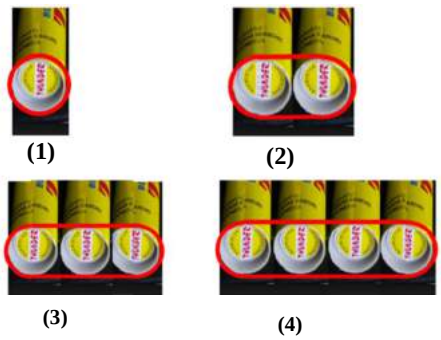
According to Nonaka and Takeuchi (1995) things which can done in knowledge sharing are: socialization, externalization, combination and internalization. Principles in knowledge sharing strategy according to Burch (2007:26) are as follow: (a) the more knowledge shared, the more new knowledge grow; (b) knowledge cannot be transferred, but only can be shared; (c) each person in group posses valuable knowledge; (d) diversity of experience and opinion should be respected in order that sharing process can be implemented well; (e) each student posses knowledge about topic which is discussed, the contribution of each person is equally valuable and respected; (f) in discussion group which is connected with certain topic, there is none feel better (all members are expert); (g) acknowledge the others contribution which can change and increase knowledge, both individually or collective; (h) acknowledge that time is valuable, so it is important to value the time which is given to talk about another participation and impede process interaction.

Learning activity which uses knowledge sharing strategy will trigger teacher in preparing learning set with context problem or situation correctly. Context or situation problems which is presented to students in learning by knowledge sharing strategy is made to become sharing experience when building new knowledge. Process of new knowledge sharing shapes student's sense of responsibility and self development in order to help peers in solving the problems. Students actively learn in small and big group, accompanied by discussion with appropriate information source, discussion result is presented with self-confidence.

Teacher guidance is given directly or indirectly in accord with student's need. Direct guidance is given at the time of discussion process, teacher direct discussion if students swerve from theme or topic which is discussed, ask learning source and give justification toward student's argument or idea which is not correct. Indirect guidance through scaffolding, that is by giving questions which is directing or by asking student either in one group or in another group. Following is example of case in mathematics learning by using knowledge sharing strategy with some questions which challenge students.

Example of case 1. A sport store is offering promotion to sport equipment purchase. The store give some direct bonuses. Direct bonuses which are given among others is one slop of shuttlecock badminton for each purchase by multiple Rp.200.000. Slop shuttlecock as bonus always arranged stretch along a length and both edges are tied by red ribbon, such as in some example as follow:

Figure 1.
Slop of Badminton Shuttlecock



From situation which is given in Example of Case 1, some possible questions which can be asked, for example: (a) what can you know from situation above?; (b) do you see regularity from the ribbon tied?; (c) can you determine the length of ribbon in picture 1, 2, 3 and 4 above?; (d) what

reason that make you give that answer?; (e) can you determine the length of ribbon which is needed to tie 10 slop shuttlecock?; (f) how do you explain that answer?; (g) how if *n* is slop shuttlecock?; (h) how to determine the general form of length of that ribbon?; (i) if customer make a purchase at the price of Rp.1.540.000, how long of the ribbon which is needed to tie the amount of slop shuttlecock badminton bonus which is obtained by that customer?; (j) is there any who has another answer?

Subsequently, there are some questions which are directed by teacher as scaffolding when student gives answer reason to question from another students, namely: (a) explain completely the answer reason of problem which is given? (b) inform learning source which is used as reinforcement; (c) explain strategy which is used; (d) predict the possibility which can be happened; (e) identify inappropriate question; (f) develop question to create relevant problem. Steps in using learning by knowledge sharing strategy in this study are as follow:

a. Socialization stage. Students is given opportunity by teacher to know how to recognize, identify and search information source which is needed as much as possible about situation which become key topic in learning process in class. A student can restructure knowledge by giving and taking information from each other in the form question, statement, and give various logical example, connected to certain mathematics concept.

b. Combination stage. Student elaborates and combines analysis, identification result information, and process information by teacher direction. Students are encouraged to hold discussion, dialog, present information they collect. When discussion takes place, students share and compare each other their finding and perspective which is believed to make similarity and difference which is supported by learning source (book, module, article, journal, etc).

c. Externalization stage. Students try to redefine and acknowledge with expression toward concept which is known so far but they are wrong to understand it, so set knowledge with new understanding which is true. This expression can be shown to students as well as group as confirmation process of self evaluation result in transforming original understanding into new understanding whose the truth is convinced.

d. Internalization stage. Students transform old knowledge to shape and build mindset in obseving reality meaningfully from new knowledge obtained. In this stage, a student has been able to use and apply new knowledge to explain ideas, predict phenomena, and construct argument to create new knowledge possessed with various problem solution from situation presented by teacher.

Formulation of Study Problem

Based on the explanation above, the problem of this study is formulated as follow: (1) Is there enhancement difference of mathematical reflective thinking ability between students who follow knowledge sharing learning strategy (KSS) and students who follow conventional learning (CL)?; (2) Is there enhancement difference of mathematical reflective thinking ability between students who follow knowledge sharing learning strategy (KSS) and students who follow conventional learning (CL) based on school level and student's prior mathematical knowledge (higher, midlle, lower)?; (3) Is there influence of interaction between learning (knowledge sharing strategy, conventional learning) and student's prior mathematical knowledge (higher, midlle, lower) in

enhancement of student's mathematical reflective thinking ability?; (4) How the description of mathematical reflective thinking ability of students who follow knowledge sharing learning strategy?

III. METHOD OF STUDY

This method of this study is quasi experiment by non-equivalent control group design, pretest-posttest control group. The population of this study are eighth grades students of Senior High School in Tangerang City, Banten Province in 2013/2014 academic year. Sampling of school level (midlle, lower) by stratified random sampling technique, based on grade average of National Examination, whereas group of study is determined by cluster random sampling technique. The experiment group got learning by knowledge sharing strategy and control group by conventional learning. Schools which are selected as sample of study are SMAN 12 Tangerang and SMAN 13 Tangerang. In a whole, sample used in this study consists of 140 students. Instruments used are prior mathematical knowledge test and mathematical reflective thinking ability test.

Data analysis which is used are one-way ANOVA, two-way ANOVA and General Linear Model (GLM) in the form of Scheffe Test. Requirement tests which are done are data normality test (Kolmogorov-Smirnov *Z* Test) and homogeneity test (Levene Test). Analysis of enhancement use average normalized gain by Metlzer (2002). Statistic test is done by IBM SPSS Statistic 19 software aid.

IV. RESULT AND DISCUSSION OF STUDY

1. Result of Study

Based on pretest, posttest data, many samples (*N*), and Standard Deviation (*SD*) of mathematical reflective thinking ability test, N-Gain value is analyzed based on learning strategy, school level and prior mathematical knowledge (PMK). Descriptively, the result of study about mathematical reflective thinking ability (MRTA) is described in Table 1 as follow.

Table 1. Data of Student's Mathematical Reflective Thinking (MRTA) Ability N-Gain based on Learning Strategy, School Level, and Prior Mathematical Knowledge (PMK)

School Level	MIK	Statistic	Learning					
			KSS			CL		
			Pretest	Posttest	N-Gain	Pretest	Posttest	N-Gain
Middle	Higher	*N*	8	8	8	9	9	9
		Mean	10.875	19.375	.935	6.000	16.444	.743
		SD	.834	.518	.054	1.871	2.505	.174
	Middle	*N*	18	18	18	16	16	16
		Mean	6.722	15.556	.670	6.812	13.625	.497
		SD	1.841	2.229	.155	2.428	2.125	.185
	Lower	*N*	9	9	9	10	10	10
		Mean	4.778	14.778	.661	5.700	9.700	.262
		SD	1.986	2.539	.144	2.057	1.767	.189
Lower	Higher	*N*	9	9	9	9	9	9
		Mean	7.444	18.000	.845	10.444	16.889	.669
		SD	1.944	1.414	.109	.726	.782	.102
	Middle	*N*	19	19	19	18	18	18
		Mean	7.053	13.842	.505	7.611	13.222	.469
		SD	2.738	1.608	.167	3.310	1.592	.135
	Lower	*N*	7	7	7	8	8	8
		Mean	6.714	12.286	.415	4.500	8.625	.263
		SD	2.138	1.890	.141	1.414	.744	.049

*The ideal score of MRTA is 20.

Based on data description in Table 1, it is obtained data analysis result of student's mathematical reflective thinking ability enhancement is as follow:

1) In a whole, students learning with KSS obtain MRTA average of 15.414 (there is enhancement of .652) and students learning with conventional obtain MRTA average of 13.171 (there is enhancement of .405).

2) Students in medium-level school, students learning with KSS obtain MRTA average of 16.229 (there is enhancement of .728) and students learning with conventional obtain MRTA average of 13.229 (there is enhancement of .493).

3) Students in low-level school, students learning with KSS obtain MRTA average of 14.600 (there is enhancement of .575) and students learning with conventional obtain MRTA average of 13.114 (there is enhancement of .473).

4) In high category PMK, students learning with KSS obtain MRTA average of 18.647 with standard deviation of 1.272 (there is enhancement of 0.888) and students learning with conventional obtain MRTA average of 16.667 with standard deviation of 1.815 (there is enhancement of .706).

5) In PMK with medium category, students learning with KSS obtain MRTA average of 14.676 with standard deviation of 2.096 (there is enhancement of .586) and students learning with conventional obtain MRTA average of 13.412 with standard deviation of 1.844 (there is enhancement of .482).

6) In PMK with low category, students learning with KSS obtain MRTA average of 13.688 with standard deviation of 2.549 (there is enhancement of 0.553) and students learning with conventional obtain MRTA average of 9.222 with standard deviation of 1.478 (there is enhancement of .263).

Result of difference testing toward mathematical reflective thinking ability after getting those learning (knowledge sharing strategy, conventional) can be seen in Table 2 as follow.

Table 2. Analysis Result of One-Way ANOVA
Test Mathematical Reflective Thinking Ability (MRTA) N-Gain
based on Learning Strategy

	Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
Between Groups	.994	1	.994	21.489	.000
Within Groups	6.383	138	.046		
Total	7.377	139			

Result of difference testing toward enhancement of mathematical reflective thinking ability based on learning strategy (sharing knowledge strategy, conventional) and school level (middle, lower) can be seen in Table 3 as follow:

Table 3. Analysis Result of Two-Way ANOVA Test Mathematical Reflective Thinking Ability (MRTA) N-Gain based on Learning Strategy and School Level

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.257[a]	2	.628	14.069	.000
Intercept	45.072	1	45.072	1008.995	.000
Learning	.994	1	.994	22.250	.000
School Level	.263	1	.263	5.888	.017
Error	6.120	137	.045		
Total	52.449	140			
Corrected Total	7.377	139			

a. R Squared = .170 (Adjusted R Squared = .158)

The result of difference testing toward enhancement of mathematical reflective thinking ability is based on learning strategy (knowledge sharing strategy, conventional) and that prior mathematical knowledge (PMK) can be seen in Table 4. as follow.

Table 4. Analysis Result of Two-Way ANOVA Test Mathematical Reflective Thinking Ability (MRTA) N-Gain Based on Learning Strategy and Prior Mathematical Knowledge (PMK)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.819[a]	3	1.273	48.664	.000
Intercept	41.691	1	41.691	1593.744	.000
Learning	.993	1	.993	37.975	.000
PMK	2.825	2	1.413	53.999	.000
Error	3.558	136	.026		
Total	52.449	140			
Corrected Total	7.377	139			

a. R Squared = .518 (Adjusted R Squared = .507)

Result of interaction testing between learning strategy (knowledge sharing strategy, conventional) and school level (middle, lower) toward enhancement of mathematical reflective thinking ability used General Linear Model (GLM) by Two-Way ANOVA which is presented in Table 5. as follow.

Table 5. Analysis Result of Interaction between Learning Strategy and School Level

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.414[a]	3	.471	10.752	.000
Intercept	45.072	1	45.072	1028.046	.000
Learning	.994	1	.994	22.670	.000
School Level	.263	1	.263	5.999	.016
Learning*School Level	.157	1	.157	3.587	.060
Error	5.963	136	.044		
Total	52.449	140			
Corrected Total	7.377	139			

a. R Squared = .192 (Adjusted R Squared = .174)

Result of interaction testing between learning strategy (knowledge sharing strategy, conventional) and prior mathematical knowledge (higher, middler, lower) toward enhancement of mathematical reflective thinking ability used General Linear Model (GLM) by Two-Way ANOVA which is presented in Table 6. as follow.

Table 6. Analysis Result of Interaction between Learning Strategy and Prior Mathematical Knowledge (PMK)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.021[a]	5	.804	32.110	.000
Intercept	41.860	1	410.860	1671.456	.000
Learning	1.149	1	1.149	45.881	.000
PMK	2.777	2	1.389	55.444	.000
Learning *PMK	.202	2	.101	4.028	.020
Error	3.356	134	.025		
Total	52.449	140			
Corrected Total	7.377	139			

a. R Squared = .545 (Adjusted R Squared = .528)

Result of testing which has higher influence toward enhancement of mathematical reflective thinking ability from each pair of prior mathematical knowledege level (higher, middle, low) is presented in Table 7. as follow.

Table 7. Scheffe Test of Student's MRTA Enhancement Among Prior Mathematical Knowledge (PMK) Level

(I) PMK	(J) PMK	Beda Rata-rata (I – J)	*Sig.*
Higher	Middle	.2582	.000
Higher	Lower	.3944	.000
Middle	Lower	.1363	.000

Based on difference testing of mathematical reflective thinking ability enhancement in Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7, the result is obtained as follow.

1) There is significant difference of mathematical reflective thinking ability enhancement between students learning with knowledge sharing strategy and students learning with conventional.

2) There is significant difference of mathematical reflective thinking ability enhancement between students learning with knowledge sharing strategy and students learning with conventional in each school level.

3) There is significant influence of mathematical reflective thinking ability enhancement between students learning with knowledge sharing strategy and conventional learning in each PMK level.

4) There is no significant influence of interaction between learning strategy and school level toward enhancement of mathematical reflective thinking ability.

5) There is significant influence of interaction between learning strategy and prior mathematical knowledge toward enhancement of student's mathematical reflective thinking ability.

6) There is significant difference in enhancement of mathematical reflective thinking ability between students with high PMK category and medium PMK, students with high PMK category and low PMK, students with medium PMK category and low PMK.

2. Discussion of Study Result

The finding show that mathematical reflective thinking ability enhancement of students who got learning by knowledge sharing strategy (there is enhancement of .625), higher than students who get conventional learning (.405). From mathematical reflective thinking ability of two learning groups, it can be concluded that mathematical reflective thinking ability enhancement of students who got learning by knowledge sharing strategy is better than students who got conventional learning.

The finding in medium school level shows that learning enhancement by knowledge sharing strategy is .728 which is higher than the students who got conventional learning which only enhanced as much as .493. The same finding result in low school level shows that mathematical reflective thinking ability enhancement of students who got learning by knowledge sharing strategy is .575 which is higher than students who got conventional learning which is enhanced as much as .473.

The finding in each category of mathematical initial knowledge (MIK), students who got learning by knowledge sharing strategy have mathematical reflective thinking ability enhancement which is better than students who got conventional learning. Another finding result show that there is no significant influence of interaction between learning strategy and school level toward mathematical reflective thinking ability enhancement. For interaction between learning strategy and mathematical initial knowledge toward enhancement of student's mathematical reflective thinking ability, it is found that there is significant influence of interaction between learning strategy and mathematical initial knowledge toward enhancement of student's mathematical reflective thinking ability.

The finding which is connected to indicators of mathematical reflective thinking ability measured show that N-Gain score average is enhanced as much as .652 with medium category. This result of

finding confirms Osborne and Wittrock opinion (1985) that students should be brave to reveal ideas clearly in their mind, knowing that in topic which is being learned there is difference conflict with the others which will force students trying to do a change.

Mathematics learning by knowledge sharing strategy is started by preparing and searching learning resource which is relevant to strengthen student's initial understanding. After teacher giving learning guide in worksheet, student is asked to list questions connected to situation or daily problems.

Students' asked to write sources which becomes reference in answering questions. This is intended to omit feeling of doubt or as reinforcement to new knowledge which is just obtained. When the process of discussion group go on, the teacher monitor students learning and give direction to group who experience confusion and difficulty by giving scaffolding as necessary. According to Dahlan (2011), when learning process take places, teacher can encourage student learning by: (1) allowing students to know that they can learn by new strategy and include their ideas independently; (2) setting the goal as learning strategy than giving assignments; (3) demonstrating strategy and self-talk about how and why something is done; (4) planning feedback of work process which is part of learning process; (5) asking student to monitor learning strategy and noting its influence. After students catch what has been directed by teacher, students are given opportunity with their own ideas to build knowledge.

New knowledge formed is communicated together with group peer in order to find mathematical concept, procedure or principles which is agree in situation and problems given. According to Turmudi (2008:55), when a student is challenged and asked to give argument to communicate his/her thinking result to other people either in verbal or in writing, he or she learn to explain and convince other people, listen ideas or explanation of others people, and give opportunity to students to develop their experience. The process of student's learning discussion can be seen in Figure 4 as follow:

Figure 2.
Learning By Knowledge Sharing Strategy (KSS)

Figure 2 shows learning process by knowledge sharing strategy. Students appear very enthusiastic in following mathematics learning. Each student give contribution for each other either in their group or in another group. In this discussion activity, there is interaction enhancement among students, indirectly students can build a new knowledge effectively.

Discussion among group giving a change to students connecting or bridging mindset either externally or internally in learning process. In knowledge sharing process, student work hard to get new knowledge supported by appropriate information and learning source. Students become more self confidence and learning become more meaningful when student can understand and use knowledge which is stored in their mind in relatively long term. This is in accord with Glaser opinion (Ferla, 2008) that meaningful learning involves new information connection and integrate it into knowledge which is obtained before.

After getting adequate knowledge, students begin to solve the problem with their own way, students give logical reason and explanation for answer. Students exchange the answer for each other and share the knowledge and give critical perception which is appropriate to get various ways, solutions and answers from one situation or case which is given by teacher in student's worksheet. When problem solving process take places, students should be able to control and evaluate their thinking process, as said by Yeo (2008) that to be success in solving various kind of mathematical problem, a student should has four kinds of readiness, namely: specific mathematical concepts understanding, skill, process and metacognition attitude to solve the problem.

After group has the answer of problem which is given by activity can continued by delivering group idea in the front of class, teacher giving reinforcement directly if there is concept misunderstanding and giving emphasis firmly which becomes a goal in learning in the form of reflection.

6. Whether $x\sqrt{3} + y = 10$ is one of the equations of the tangent of the circle $x^2 + y^2 = 25$ drawn from point (0,10)? give your reasons!

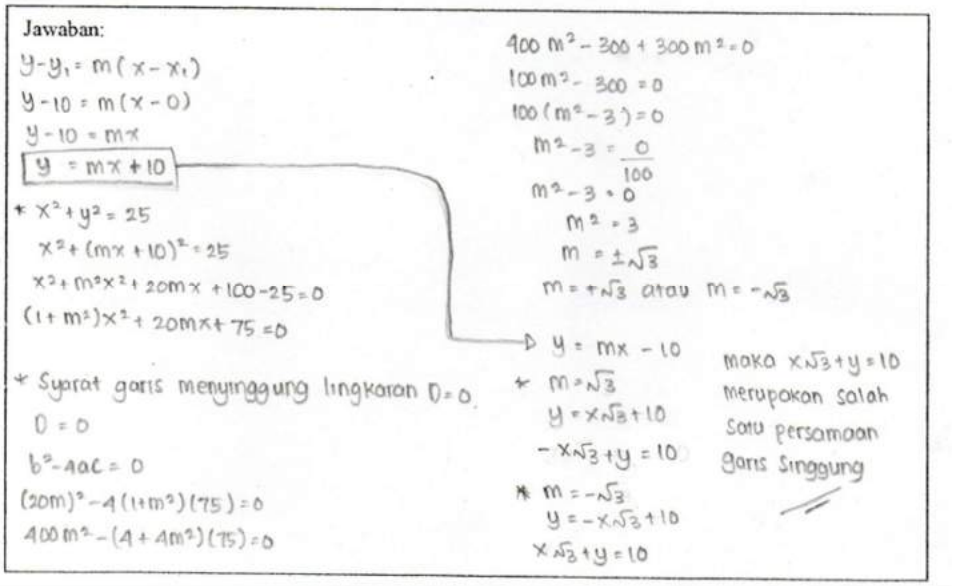


Figure 3. Example of Student's Performance in Evaluating Based on Mathematical Concept

In Figure 3, students' performance got maximal score of 4. This is because students have been able to evaluate action and what is believed by comparing reaction to general principle or theory, and

completely give reason and correct answer. Student's mathematical reflective thinking ability was started by writing line equation through one point, that is $y - y_1 = m(x - x_1)$ then substitute information which is known until find line equation $y = mx + 10$. Then students written the requisite of line to contact circle $D = 0$, for value D is substituted into $b^2 - 4ac = 0$. In the end of solution, students make conclusion as confirmation that what have been evaluated has the truth. Students performance have been able to evaluate or examine a statement/reason/argument based on mathematical concept/property which is used as aspect in mathematical reflective thinking ability.

V. CONCLUSION AND RECOMMENDATION

1. Conclusion

Based on explanation of result and discussion of study, conclusions about student's mathematical reflection thinking ability and knowledge sharing learning strategy are obtained as follow:

1) There is enhancement difference of mathematical reflective thinking ability between students who follow knowledge sharing learning strategy and students who get conventional learning.

2) There is enhancement difference of mathematical reflective thinking ability between students who follow knowledge sharing learning strategy and students who get conventional learning based on school level and student's mathematical prior knowledge (higher, middle, lower).

3) There is significant influence of interaction between learning strategy and school level toward enhancement of mathematical reflective thinking ability.

4) There is significant influence of interaction between learning strategy and mathematical prior knowledge toward enhancement of student's mathematical reflective thinking ability.

2. Recommendation

Based on explanation of study result and conclusion, recommendations which are suggested by author are as follow:

a) Mathematical reflective thinking ability need to be trained and developed by students in order to know quickly the mistake which has done in solving mathematical problem to be corrected immediately.

b) Learning by knowledge sharing strategy can be used in learning implementation in class as an effort to enhance student's mathematical reflective thinking ability. Students who follow knowledge sharing learning strategy have opportunity to deliver idea in which they believe its truth to be delivered to another student accompanied by reason and logical explanation in searching mathematical problem solution in daily life.

c) In this study, the enhancement of mathematical reflective thinking ability indicators only achieve middle category. Therefore, next research is needed in order that contribution in enhancing the quality of mathematical reflective thinking ability to be more optimal.

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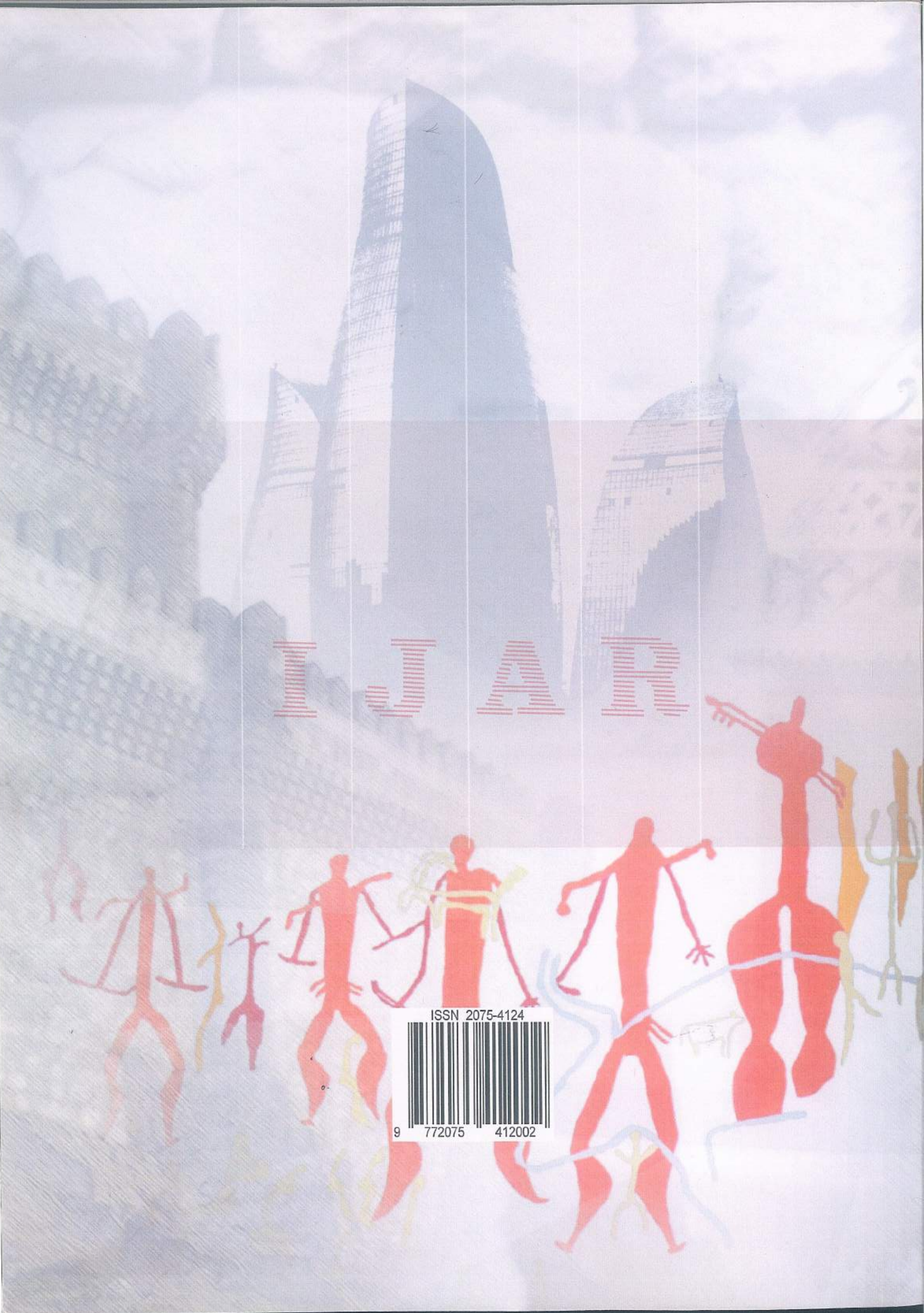

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PART B. SOCIAL SCIENCES AND HUMANITIES

IMPROVING EFL STUDENTS' READING COMPREHENSION THROUGH COHESIVE DEVICES AND WEBBING INSTRUCTIONS

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ABSTRACT

English for Academic Purposes courses requires EFL students to be familiar with the grammatical structures and much of the vocabulary, and they are expected to comprehend English authentic texts. Problem may arise; however, when the students are not skilled and have a low level of English proficiency. For this reason, the present study aims at investigating how the cohesion, webbing, and cohesion plus webbing could improve the EFL students' reading comprehension. To conduct this research, some students were randomly selected and assigned into four groups: one control and three experiments. After the treatment, the collected data of pre-and post-tests scores were analyzed by using t-test and f-test. The results strongly suggest that the Indonesian EFL students with a low level are (1) highly sensitiveof cohesion, (2) heavily dependent on the bottom-up reading process, and (3) able to use interactive reading process after they were instructed the cohesion plus webbing. In spite of its limitation, the study offered suggestions to EFL language teachers in implementing the explicit instruction of cohesion and webbing before reading activities.

Key words: Cohesive devices, Webbing, EAP, EFL, Reading Comprehension

1. INTRODUCTION

In Indonesia, particularly at a university level, such as the faculty of economics which provides Indonesian EFL students a course of English for Academic Purposes (EAP), reading English texts is considerably very essential for some reasons. First, English, as foreign language, is not used as a medium of instruction and daily communication in and outside classes. Next, the Indonesian EFL students at the faculty of economics are requested to read English books and journals related to their subjects or courses. Third, reading English texts is often the only available exposure for EFL students to the target language. These situations suggest that there is a need for reading comprehension courses in English, especially EAP with the aim at providing EFL students with skills needed to meet their English reading requirements for their academic courses.

The problem is that most Indonesian EFL students at university are not skilled and have a low level of foreign language proficiency [1]. Therefore, an empirical study must be made in order to facilitate how Indonesian EFL students with a low level of English proficiency can cope with their problems. One of the ways to assist them is providing an instruction of cohesion, webbing, and cohesion plus webbing which is conducted in this study.

2. COHESION

The concept of cohesion which is coined by [2] refers to meaning relation occurring within texts. The existing cohesive elements, as devices, can make the texts coherent, which means that the texts hang together. As [3] states that "for a text hang coherent it must be cohesive; ...." In this sense, cohesive devices are considered as the essential factor in making the text coherent.

Several studies have revealed that understanding cohesive devices is crucial for EFL/EAP students because the cohesion knowledge can facilitate the students comprehend the texts. As [4] who analyzed English Business and Economy (EBE) texts, showed that cohesive devices were frequently used in the EBE text. Based on the finding, she suggested that teachers should include cohesion in the curriculum and teaching of reading comprehension. Another study was conducted by [4] who examined the cohesive performance of practiced and unpracticed of Malaysian students. He found that unpracticed readers, who were exposed to only in their native Malaysian tongue, found difficult to understand both grammatical and lexical cohesion and comprehend the meaning relations between sentences because of their inability to comprehend sentence connectors. Next, [5] investigated the reading threshold needed for EAP texts and found that grammatical cohesion was one of the most important element for understand the EAP text. Similarly, [6] who made the study of the effect of discourse markers on comprehension of lectures found that both markers could facilitate the understanding of the lecture. Arecent study also revealed that lexical cohesion plays an important role in both spoken and written comprehension [7].

The above lines of researches have confirmed the importance of cohesive devices in reading comprehension. These lead to the need of instruction of cohesive devices to EAP students in the classroom. While a small number of the investigations of the cohesive devices instructions have done up to date, this present study is an attempt to investigate the effect of cohesive devices instruction on EFL students' comprehension of economics texts.

3. WEBBING

The web is originally associated with a network of fine threads that a spider weaves. In language teaching and learning, it represents the relation between a concepts or objects which can be used to activate readers' background knowledge related to the content of the text. According to [8], "webbing is used as flexible instructional strategy at all instructional level." Webbing, like maps, can be applied in the classroom teaching from elementary schools to colleges or

university. As a teaching instruction, webbing can promote comprehension since it permits the new to related to the known, and builds personal involvement with texts.

As [9] offers some steps in creating web. A teacher starts writing the topic of the reading passage on the board, and then asks students what they have known about the topic and what they want to know. They are asked to write their answers on the board around the topic to generate a web. After generating many words related to the topic, students are requested to organize the web into major topics and subtopics. At last, the topics, major topics, and subtopics are put into some kinds of a logical order, such as collection of description, cause & effects, and comparison & contrast. The concept of webbing is sometime also called mapping, is believed to be a useful instruction to activate or empower students' experience or background knowledge related to the content of a text [10[11].

Some previous studies related to webbing have been conducted by several researchers. [12], for example, remarked the value of semantic webbing in the pre-reading instruction to prepare EFL/ESP students for the reading of texts. She further suggested that the webbing instruction could make readers' awareness of devices. Similarly, [13],[10] and [11] stated that the semantic webbing or mapping could activate students' background knowledge. They suggested that teachers related various concepts and key words surrounding particular topic on the board and helped students clearly see the possible relationships between the ideas or concept discussed.

All previous studies on webbing mentioned above showed that webbing could be used to activate students' background knowledge related to the topic of texts being discussed so that they can comprehend the content of texts very well. However, a few questions still remain whether the webbing instruction is effective for EFL students who have a low level of English proficiency. This present study attempt to investigate to what extend the webbing instruction can improve the comprehension of EFL students with a low level of English proficiency.

4. COHESION PLUS WEBBING

In the reading research, particularly in ESL/EFL, there have been debates among researchers concerning the role of language background knowledge, such as cohesive devise, and background knowledge which can be activated through webbing activity. On the one hand, some researchers, such as [14], [15],[16], [17] who used the top-down approach as the basis of their studies claimed that using top-down methods of instruction had indeed strong effects on students' reading comprehension. On the other hand, other researchers, such as [18] and [5], who applied the bottom-up approach, had also affirmed that language knowledge had significant effects on students' reading comprehension.

It seems that all the above studies have not yet been conclusive and definitive, but suggestive. This may imply that in order to understand reading texts, researchers have to examine the possible effect of both language and background knowledge because there must be a kind of interaction of linguistics knowledge, such as vocabulary or cohesive devices and background knowledge, like the experience and familiarity of topic of texts being read. For this reason, the present study also aims at finding out the impact of the combining cohesion and webbing (cohesion plus webbing) instruction on EFL students' reading comprehension with a low level of English proficiency.

In the light of the above review of some related literatures, it is hypothesized that the cohesive devices, webbing, and cohesive plus webbing instructions will be better than no instruction of cohesive, webbing, and cohesive plus webbing, in particular:

H1: EFL students would comprehend English economics texts better when cohesion instruction is given than no cohesion instruction.

H2: EFL students would comprehend English economics texts better when webbing instruction is given than no webbing instruction.

H3: EFL students would comprehend English economics texts best when cohesion plus webbing instruction is given compared to merely webbing or cohesion instruction.

5. METHODOLGY

On the basis of the literature review discussed above, this study aimed at finding out the impact of instructional cohesion (COH), webbing (WEB), and cohesion plus webbing (COH+WEB) on Indonesian EFL students' comprehension of economics texts as their EAP course at the university.

6. RESEARCH QUESTIONS

Some research questions are addressed as follows:

1. Can *COH* instruction improve EFL students' reading comprehension?
2. Can *WEB* instruction improve EFL students' reading comprehension?
3. Is *COH+WEB* instruction better than *COH* or *WEB* in improving EFL students' reading comprehension?

7. RESEARCH DESIGN

This study was designed as an experiment, consisting of four groups—COH, WEB, COH+WEB, and Control (C) groups.COH group was given cohesive devices instruction, WEB webbing instruction, COH+WEB cohesive devices plus webbing instruction. As for C group, no instruction of cohesion and webbing, but they were provided texts along with some exercises every sessions. Prior to and after the treatment, all groups were given the reading comprehension test. Thus, there were three independent variables and the reading comprehension as the dependent one.

8. SUBEJCTS

The subjects of the study were students of the faculty of economics. There were 160 students who were assigned into four groups. They took English for Academic Purposes (EAP). Prior to study at the university, they had learnt general English when they were at senior high schools. But their language proficiency was still relatively at low level. Out of the total number of students, 75 percent had TOEFL scores at the range of 350-400.

9. MATERIALS

All selected materials for instruction or treatment and per-and post-tests were adapted from a textbook designed by the researcher, namely Business English for EFL Students of the Economics Faculty [19] and articles or journals of economics. On the basis of these materials, the assessment was conducted to see the extent to which the subjects' awareness and skills of webbing and cohesion improved.

10. PROCEDURES

The procedures of the study cover the process of instruction as the treatment, instruments, and data analysis.

11. INSTRUCTIONS

The procedures for the presentation of the instructions were similar, except for the control group. The instructions began with arousing the students' interest, activating background knowledge (webbing instruction), linguistic knowledge (cohesion instruction), and combining cohesion and webbing instruction.

The cohesion instruction and the webbing instruction each took about 90 minutes, sixty minutes for cohesion and webbing explicit instruction and thirty minutes for exposure or exercises. The combining cohesion plus webbing also took 90 minutes—sixtyminutes for cohesion and webbing explicit instruction and thirty minutes for exposure or exercises. The instruction were based on a lesson plan which was set up by the researcher with the purpose of providing a clear direction of what the instructors were going to teach the students.

12. INSTRUMENTS AND ANALYSIS

The reading comprehension test was constructed and designed for the pre-test and post-test. The pre-test was used to obtain the base line data of the subjects' reading comprehension skills. The post-test which also indicated whether the subjects had made significant progress after they had been instructed was used as the inferential comprehension variable. Both the pre- and post-tests consisted of three passages with multiple choices form and shorts answers.

The pre- and post-tests scoreswere analyzed using a One-way ANOVA (analysis of variance) because of several assumptions. First, there was one dependent variable (scores of the pre-and post-tests reading comprehension), and one independent variable with four levels: cohesion, webbing, cohesion*webbing, and control. Thus, the comparisons were made in only one direction. Second, the data were independent (not-repeated-measures), meaning each subject contributes one score to only one group, and the comparison was between groups. Third, the data in the respective populations from which samples were drawn were normally distributed.

At last the quantitative data were analyzed by using the Paired Sample t-test in order to find out the effect of each instruction on reading comprehension, and the Post Hoc Test was performed to locate differences among means.

13. RESULTS AND DISCUSSION

The results of the analysis are presented in in the following sections:

14. EFFECT OF INSTRUCTIONS

The effects of the four instructions: cohesion, webbing, cohesion plus webbing andcontrol on reading comprehension to the COH, WEB, COH+WEBand C groups are analyzed by using the t-test. The statistic tests are used to examine if the post-test scores of reading comprehension are better than the pre-tests or in other words to find out whether there are significant improvement of the instruction on students' reading comprehension. To examine the improvement, the scores of the pre- and post-tests of reading comprehension collected from thefour groups were compared and analyzed.

The results of the t-tests for the four groups are elaborated as follows: first, the result of Paired Samples t-test for the controlinstruction on reading comprehension to the C group revealed that the mean scores of the pre-test (M=11.68) were higher than the post-test (M=10.58). A further t-test (Table 2) revealed that the observed value of t was 1.638. This value did not meet or exceed the critical value of t-table (2.226). Thus, the t-test was to, 025, 39 = 1.638 < 2.226, meaning that the observed value of t was extremely far from the critical value of t. The Sig.(2-tailed) of approximately 0.109 exceeding the alpha 0.05 (Sig = 0.109 > 0.05) strongly suggested the acceptance of the null hypothesis, stating no different mean scores between the pre- and post-tests of the reading comprehension. Therefore, these results strongly confirmed no significant effect of the control instruction: the traditional teaching of reading (no treatment of cohesion or cohesion plus webbing in the pre-reading activity) did not improve the students' reading comprehension.

Table 1. Means of the pre-and post-test scores for the control group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.68	40	2.912	.460
POST TEST	10.58	40	3.889	.615

Table 2. Paired samples t-test for the control group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	1.10	4.247	.672	-.26	2.46	-1.638	39	.109

Second, the result of Paired Samples t-test for the Cohesion instructionon reading comprehension to the COH group revealed that the mean score (the second column of Table 3) of the pre-test (M=11.60) was smaller than the post-test (M=14.95). A further t-test revealed that the observed value of t was 5.479 (table 4). This value was greater than the critical value of t (2.026). So the t-test was to, 025, 39 = 5.479 > 2.026, meaning that the observed value of t was absolutely greater

than the critical value of t. The P-value of approximately 0.00 which was lower than the alpha 0.05 (Sig = 0.00 < 0.05) strongly suggested the acceptance of the hypothesis (H1), stating that students would comprehend the text better when the cohesion teaching was given than no cohesion teaching was given. Therefore, these results evidently verified a significant effect of the cohesion treatment: the explicit instruction of cohesive devices in the pre-reading activities could improve the students' reading comprehension.

Table 3. Means of the pre- and post-test scores for the COH group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.60	40	3.028	.479
POST TEST	14.95	40	3.046	.482

Table 4. Paired samples t-test for the COH group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-3.35	3.867	.611	-4.59	-2.11	-5.479	39	.000

Next, the result of Paired Samples t-test for the Webbing treatment on reading comprehension to the WEB group revealed that mean score (Table 5) of the pre-test (M=11.10) was more or less the same as the post-test (M=11.65). A further t-test revealed that the observed value of twas 0.941 (Table 6). This value did not meet or exceed the critical value of t (2.226). Thus, the t-test was to, 025, 39 = 0.941 < 2.226, meaning that the observed value of t was lower than the critical value of t-test. The P-value of approximately 0.353 exceeding the alpha 0.05 (Sig = 0.353 > 0.05) suggested the acceptance of the null hypothesis (H0), stating that there was no significant effect of webbing on reading comprehension. Therefore, these results strongly confirmed that the explicit teaching of webbing in the pre reading activities did not help the students improve their reading comprehension.

Table 5. Means of the pre-and post-test scores for the WEB Group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.10	40	2.889	.457
POST TEST	10.63	40	3.094	.489

Table 6. Paired samples t-test for the WEB Group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-.53	3.530	.558	-1.65	.60	-.941	39	.353

At last, the result of Paired Samples t-test for the Cohesion plus Webbing treatment on reading comprehension to the E3 group revealed that the mean score (Table 7) of the pre-test (M=11.80) was higher than the post-test (M=19.00). A further t-test revealed that the observed value of t-test was 13.970 (Table 8). So the result of the t-test was to, 025, 39 = 13.970 > 2.022, meaning that the observed value of t was absolutely greater than the critical value of t. The P-value of approximately 0.00 which was lower than the alpha 0.05 (Sig = 0.00 < 0.05) strongly suggested the acceptance of the hypothesis (H3), stating that students would comprehend the next better when the cohesion plus webbing was given than no teaching of cohesion plus webbing. Thus, these result strongly confirmed the significant effect of the cohesion plus webbing: the explicit instruction of cohesive devices plus webbing in the pre-reading activities could help the students improve their reading comprehension.

Table 8. Means of the pre-and posttest scores for the COH+WEB group

Pair 1	Mean	n	Std. Deviation	Std. Error Mean
PRE-TEST	11.80	40	2.972	.470
POST TEST	19.00	40	2.470	.391

Table 8. Paired samples Test for the COH+WEB group

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PRE-TEST-POST TEST	-7.20	3.260	515	-8.24	-6.16	13.970	39	.000

From the results of t-test analysis presented in Table 1-8, the significant differences in mean scores of the four groups were statistically obvious. These results, however, did not pinpoint where the significant differences lied and raised more questions: *Was the mean of the C group different from the COH group? Was the mean of the C group from the WEB group? Was the mean of the C group different from the COH+WEB group? Were all the four means different?* To respond these questions, the *Post-hoc test* was conducted and the results are presented in Table 9.

Table 9 indicates that the mean scores between that two experimental (*COH* and *COH+WEB*) groups and the control (*C*) group were significantly different. These result confirmed that were indeed the significant effects of the cohesion and cohesion plus webbing teaching on reading comprehension in the *COH* and *COH+WEB* groups. But it also shows that the mean scores between the other experimental (*WEB*) group and the control (*C*) group were not statistically significant. These results did not support to the hypothesis two stating that the webbing teaching had affected reading comprehension in the *WEB* group. These significant differences in mean scores between the *COH*, *WEB*, and *COH+WEB* group and the *C* group required further elaboration.

Table 9. Post Hoc Test

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Class C	Class COH	-4.38 (*)	.708	.000	-5.77	-2.98
	Class WEB	-1.05	.708	.140	-2.45	.35
	Class COH+WEB	-8.43 (*)	.708	.000	-9.82	-7.03
Class COH	Class WEB	3.32 (*)	.708	.000	1.93	4.72
	Class COH+WEB	-4.05 (*)	.708	.000	-5.45	-2.65
Class WEB	Class COH+WEB	-7.38 (*)	.708	.000	-8.77	-5.98

**The mean difference is significant at the.05 level*

The *COH* group mean difference was listed as 4.38 which was higher than the mean of the *C* group, and the asterisks (*), indicating a significant difference at the level.05, was displayed next to it. These result suggested that the subjects who received the teaching of the cohesive ties had better post-test scores than the subjects who did not receive it. These results strongly confirmed the significant effect of the cohesion treatment on reading comprehension: providing knowledge of the cohesive devices to the students before reading could improve their reading comprehension.

The *WEB* group mean difference was 1.05 which was absolutely low and not statistically significant compared to the mean of the *C* group. This insignificant result implied that the subjects who received the webbing treatment did not have better post-test scores than the subjects who did not receive it. Thus, the evidence verified no significant effect of the webbing on reading comprehension: only providing webbing treatment to the students in the pre-reading did not improve reading comprehension.

The third experimental (*COH+WEB*) group mean difference was 8.43. This result was apparently higher than the mean of the *C* group and statistically very significant. These substantial results suggested that the subjects who received the webbing plus cohesive ties treatment had better scores than the subject who did not receive it. Thus, these findings strongly confirmed the significant effect of cohesion plus webbing treatment on reading comprehension: providing knowledge of cohesion devices combined with webbing before reading could improve reading comprehension.To recapitulate, the *Post-hoc test* strongly confirmed the significant effects of the cohesion and cohesion plus webbing treatment but insignificant effects of the webbing and traditional (control) treatments on reading comprehension.

15. DISCUSSION

In the light of the above analysis, some major results are discussed further and used to respond the research questions.

RESEARCH QUESTION NUMBER ONE

Can COH instruction improve IndonesianEFL students' reading comprehension?

The result of the *post-hoc test* and *paired-sample test* for the COHgroups revealed thatthe cohesion instruction strongly confirmed that the cohesion instruction can improve the students' reading comprehension. The result provided the evidence to the importance of the cohesive devices to EFL students. The finding suggest that recognizing and understanding the cohesive devices, such as references, word repetitions, conjunctions, and synonyms, are very essential for readers because these devices signalize the story line of a story which facilitates the readers comprehend the text better. For example, being aware of cohesive devices could make readers easy to identify the topic sentence and the organization of paragraph, such as description, cause & effect, comparison & contrast. Thus, the findings lend to support some previous claims stating that cohesive devices play a vital role in reading comprehension, and understanding them can facilitate readers to comprehend texts ([4], [20],[21]). The finding also implies that the EFL students in this study relay on their linguistics background knowledge, meaning that they have to read sentences by sentence and to understand meanings of words by words. These reading strategies, called a bottom-up strategy, may normally be employed by the EFL students at a low level of English proficiency. It is obvious that the explicit instruction how to recognize and identify cohesive ties is the essentially helpful for the students to comprehend economics texts. This finding endorses strongly a number of studies which have indicated that explicit teaching of linguistic elements can facilitate and improve EFL students' reading comprehension ([22], and [23]..

RESEARCH QUESTIONS NUMBER TWO

Can WEB instruction improve Indonesian EFL students' reading comprehension?

The result of the *post-hoc test* and *paired-sample test* for the WEB groups indicated thatthe webbing instruction cannot improve the students' reading comprehension though the mean score of the students in the webbing group was higher than the students in the control group who did not receive the webbing teaching. There are possible reasons why the webbing instruction was not effective in this study. For one thing, the webbing instruction seems to be discrete linguistic items into a coherent whole by using their background knowledge. For another, it is possible that the students' background knowledge does not match with the content of the text because the influence of the background knowledge is not predictive, but rather, selective. This means that there are possibilities of mismatch between the background knowledge and the content of the text though the students had been provided key words or concepts related to the topic of the texts in the webbing instruction before reading. The result do not endorse to the top-down approach which asserts that readers will successful in comprehending a text if their background knowledge or schemata related to the topic of the text is activated through top-down strategies, such as webbing which are supported by [14] and [15]. By contrast, the result supports the assertion that it would be disadvantageous for EFL readers if they rely too heavily on the top-down approach [21]. In this study, the webbing instruction is not effective in helping the students' comprehension.. This finding is similar to the current research which revealed that semantic mapping as cognitive strategy or top-down strategy could not increase EFL students' vocabulary acquisition significantly [24]. These results may suggest that EFL students whose English proficiency at below threshold levelmay not be able yet to employ a cognitive strategy, like mapping or webbing.

RESEARCH QUESTIONS NUMBER THREE

Is COH+WEB instruction better than COH or WEB in improving Indonesian EFL students' reading comprehension?

The result of the Post-hoc test and paired-sample test for the *COH+WEB* group showed that the combined cohesion webbing instruction strongly confirmed that there was indeed a significant effect of the cohesion plus webbing on the students' reading comprehension. The result suggested that webbing could be effective in improving the subjects' comprehension if it was combined with the cohesion. One of plausible reason is that by using the combined webbing and cohesion the students utilized both webbing, as a top-down strategy, and cohesion, as a bottom-up strategy. When the student invoked the webbing strategy they predicted the tittle or topic of the text and identified the key words related to the topic. After predicting the topic, they confirmed their prediction and understanding by reading and paying attention to the cohesive ties, such references, conjunctions, and synonyms as guidance to comprehend the content, such as the main idea and important facts. This finding strongly confirms that interactive reading process exists, meaning that readers employ simultaneous process of both bottom-up and top-down strategies. As [25] suggests that pre-teaching difficult words, such as cohesive ties, make EFL students feel easy to have in their academic reading, and activating appropriate schemata, such as webbing to relate the content to their prior knowledge can facilitate them to comprehend the academic texts. Thus, at the top-down processing, readers draw on their prior knowledge and reading experience; while at the bottom-up processing, they retrieve their language knowledge, such as cohesive devices in order to decode the text.

16. CONCLUSION AND IMPLICATION

On the basis of the analysis and discussion of the findings, some conclusions are drawn to respond the three research questions. First of all, the cohesion instruction was generally quite effective. The result strongly suggested that the cohesion instruction could help the EFL students with a low level of English proficiency or below threshold level to comprehend the economics texts. Two point, at least, worth making. The first point is that understanding the cohesive devices can help the student process meaning at the inter sentential level. To read texts at this level, the students have to perceive links between sentences ([20]; [26]; [20]; [21]). The second point is that understanding cohesive ties lead to the students to comprehend the organization of texts, such as description, comparison & contrast, cause & effect, and problem-solution.

Secondly, the webbing instruction could not improve significantly the EFL students' comprehension of the economics texts as it proved somewhat ineffective and had only a week effect. The webbing instruction might put the EFL students at a disadvantage since they have not had the top-down strategy experience yet, and they tend to relay on the bottom-up strategy such as reading sentence by sentence and translating meaning of word by word. In this respect, they had to waste their time and failed to understand the meaning relations which are often signalized by cohesive devices.

Finally, the combined cohesion and webbing instruction was the most effective way to improve the EFL students' reading comprehension. The finding suggested that the students made use of webbing as the initial stage to gist key words related to the topic. After understanding the topic, they paid attention to cohesive devices which guide them to identify cohesive ties, topic sentence in order to find out the main idea and important facts or details. Obviously, the result provided supports to the assumption that reading process involves two aspects—bottom-up and top-down strategies which interact simultaneously ([27]; [21]). In particular, the study lend support to the assumption that the EFL students with at a low level results in much greater attention to the bottom-up component of comprehension, such cohesive devices, but they could invoke the webbing when it was combined with the cohesion instruction.

The study has implied that the findings could be generalized to other students with the same qualification due to its limitation of in-depth nature of the analysis and of a large number of subjects. However, there are some implications to EFL teachers. Cohesion and cohesion plus webbing instructions in the pre-reading activity offer a promising option for foreign language teachers to use in helping students read English texts, particularly the economics texts as one field of EAP. Powerful effects of understanding cohesive devices are very obvious in the present study when these devices are combined with webbing instruction. Webbing can train students activate their prior knowledge related to the topic of texts. Through webbing, students are encouraged to hypothesize and predict what message conveyed by an author. After making hypothesis, students can confirm it and read texts by employing the bottom-up strategy---paying attention to cohesive devices.

Obviously, the role of the cohesive devices in making sense of a text apparently suggests that EFL/EAP teachers can be encouraged to instruct or to train their students, who are below the threshold level, to understand the cohesive devices in order to compensate the lack of their language knowledge and to help them cope with their difficulties in comprehending the academic texts. Teachers can provide a variety of exercises that make students could sharpen their awareness of the need to keep checking, as they read texts, that they have interpreted cohesive devices in a way that make sense in the context of the text. The study also revealed that cohesion instruction, as the bottom-up strategy, can be effective if it was implemented with the instruction of webbing, as the top-down strategy; therefore, when teaching cohesion the teacher may consider webbing. In this case, they do not only improve students' foreign language knowledge but also help them activate their background knowledge so that they have an ability to predict and hypothesized the context or the topic of texts.

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Exploring Indonesian EFL Students' Reading Strategies for Economics Texts

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Abstract

The present study aims to explore the types of Indonesian EFL students' strategies to comprehend the economics texts. To identify the types of strategies, retrospections and reading comprehension tests were adopted and analyzed. The results revealed that most students with a low level of English proficiency remained more dependent on the bottom-up strategies than top-down strategies. However, using the bottom-up strategies had facilitated the students comprehend the economics texts. Thus, in spite of its limitation, the study has some implications to ESAP reading in EFL classrooms.

Key words: ESAP, reading comprehension, EFL, retrospection, bottom-up strategies, top-down strategies

Introduction

Most Indonesian EFL students at a university level are provided a course of reading comprehension for *English for Specific Academic Purposes* (ESAP). This is very imperative because university students have to read journals and other references related to their courses. In order to be able to read academic texts in ESAP, EFL students are required to have reading strategies skills (Nuttall, 1982). They are expected to be skillful readers who have the same reading competence as skillful native readers. Skillful readers, unlike unskilled readers, can apply more strategies more effectively (Barnett, 1988). Moreover, EFL students at the faculty of economics are requested to understand "the subject-context" expressed in English (Jordan, 1997). These conditions become bearers for most EFL students because of their poor strategies and low level of English proficiency. Yet, they should study ESAP courses, such as reading economics texts as one of the compulsory courses determined by the faculty. Very few studies, however, have examined EFL students' strategies to deal with this problem. Therefore, an empirical study needs to be conducted in order to understand how EFL students cope with their problems and how to develop their reading strategies.

Students' Reading Strategies for Comprehension

In the reading literature, some researchers have affirmed that reading strategies have positive impacts on comprehension. Rusciolelli (1995), who conducted a study with college Spanish students, found that skimming, for example, proved most useful strategies to students. She identified that the subjects could comprehend a text better by using skimming compared to re-reading. The finding may suggest that skimming as the top down strategy is more helpful than re-reading as the bottom-up strategy. Similarly, Carrell (1991), who investigated the strategy employed by the subjects of two groups: at lower proficiency and higher proficiency levels, found that the subjects with higher proficiency level who invoked global strategies, such as activating background knowledge and recognizing text organization comprehended texts were more successful than the subjects with lower proficiency level who used the bottom-up strategies, such as focusing on grammatical structures and word meaning. The results of the above studies, however, appear to be still suggestive rather than definitive because there is also evidence from another study revealing that students at high proficiency level in a foreign language still make use of the bottom-up strategies.

Alderson (1984, p.20) strongly remarked in his study that "proficiency in the foreign language was more closely associated with foreign language reading ability and thus reading problems are due to language problems of that language." In other words, EFL students with a low level of English proficiency may not be able to use reading strategies such as predicting and hypothesizing.

Laufer & Sim (1985) provided strong supports to the importance of the foreign language proficiency for EFL reading. Similarly, Davis & Bistodeu (1993), who investigated whether L1 and L2 reading processes were different from the subjects of native readers of French and English, supported to the threshold hypothesis. They found that the foreign language itself had a powerful impact on the psychological processing during L2 reading and the low level of linguistic proficiency resulted in much greater attention to the bottom-up strategies. On the other hand, Li & Munby (1996), who conducted their study with EFL students with a high proficiency level in English, found that the students kept translating to comprehend a text. Findings of these studies are still contradictory and remain questionable whether good readers or poor readers invoked the top-down, the bottom-up or both strategies. The evidence may trigger further study on what strategies invoked by EFL students at a university level to comprehend academic texts as a part of ESAP. Therefore, a further study is still needed to identify what types of reading strategies for comprehension invoked by EFL students, and this study attempted to investigate this problem focusing on EFL students with a low proficiency level in Indonesian setting.

Methods

Research Design

This study was designed to explore what reading strategies were invoked by Indonesian EFL students. They were given reading strategy questionnaires, called *retrospection*, and *short answers reading comprehension test.*

Subjects

The respondents were students who took English for ESAP, particularly reading comprehension. Before taking ESAP, they had learnt General English (GE). However, their language proficiency was still at below threshold level—their TOEFL scores at the range of 350-400.

Instruments

This study used two types of instruments: *Reading comprehension test with short answers* and *Retrospection*. The first instrument was a *reading comprehension test* with some questions related to the main idea, supporting ideas, inferences, and patterns of paragraphs. These questions could elicit to what extent the students' responses were accurate. To respond these questions, the subjects were requested to provide short answers as their responses to the given questions. After they responded to the given questions, they were asked to explain ways or strategies used when reading the texts. This type of obtaining students' responses was called *Retrospection* as the second instrument of the study. Retrospection is one of the verbal reports used as a means of gaining insight into the reading process in the mind of a reader; therefore, it is very useful for giving insight into strategy used in reading. Some researchers suggest that there are ways in which retrospective verbal reports can be significant to provide insightful and valid data. For example, Cohen (1986, p. 133) state that "retrospection can be immediate (e.g. within, say an hour of the reading) or delayed (a few hours, days or even a week after the reading). This is supported by Dhieb-Henia (2003, p. 393) who argues that "immediate retrospection, which is completed directly after reading task, ensure that the subjects' short-term memory can be accessed and its content reported, yet guarantees a minimum of interference with the reading process." In the present study, the immediate retrospection was applied to obtain insights into reading strategies for identifying the main idea, making inferences, and recognizing patterns of paragraphs.

Data Analysis

The data from the retrospection and the reading comprehension test were collected and analyzed qualitatively through some procedures. First, the data were classified into several types of reading strategies. In this method, the researcher carefully read the retrospection for possible codes or categories relevant to the aim of the study. Second, some reading strategies invoked by the students were analyzed to assess the accuracy of answering given questions, as some previous researchers also remarked that there were apparently relations between certain types of reading strategies and successful or unsuccessful EFL reading (Pani, 2004). In the current study, the "accuracy" refers to the ability of the subjects to identify the main idea and supporting ideas, to make inferences, and to recognize the patterns of paragraph.

Results

The data from the retrospections were classified into some types of reading strategies for (1) identifying the main idea, (2) making inferences, and (3) recognizing patterns of paragraphs. After classifying the types of strategies invoked by the students, the accuracy of comprehension was presented.

1. Types of Reading Strategies for Identifying the Main Idea

When the students were asked what reading strategies were used for identifying the main idea, they informed that they used similar bottom-up reading strategies such as, *reading sentence by sentence, re-reading, translating, recognizing cohesive devices* and *using a dictionary* for identifying the main idea. Some used *webbing; and few used washing plus reading sentence by sentence.* Nevertheless, the results of the analysis of the students' accuracy were low. For example, less than 50% of the students were able to identify the main idea accurately by using *translating* and *reading sentence by sentence* strategies. 28% of them could identify the main idea accurately by using *cohesive devices* as the bottom-up strategy and using *cohesive devices plus webbing* as the interactive strategy. Only 12 % could identify the main idea correctly by using *webbing plus reading sentence by sentence* strategies.

2. Types of Reading Strategies for Inferences

When the students were asked the strategies used for inferences, they informed that they employed the bottom-up strategies: *reading sentence by sentence, re-reading, translating, paraphrasing, and using cohesive devices.* Some used *webbing* and *webbing plus sentence by sentence or re-reading*.

The analysis of the accuracy in drawing conclusions revealed that 30% of the students could make inferences accurately. When using *cohesive devices*, and *webbing plus cohesive devices*, most (70%) students were able to draw conclusion accurately.

3. Types of Reading Strategies for Patterns

The two bottom-up strategies, *paraphrasing* and *reading sentence by sentence,* were invoked by most students for recognizing patterns of paragraphs. A few made use of *cohesive devices* as the other strategy. With regard to accuracy, the results revealed that 25 % of the students could recognize the organization of the paragraph correctly by *paraphrasing, re-reading* or *translating*, while 75 % of the students employed *cohesive devices* for recognizing the organization of the paragraph.

Discussion

The results revealed that EFL students invoked some types of reading strategies which were effective and ineffective for their comprehension. The retrospective data indicated that the strategies, starting from the most to the least frequent strategies: *reading sentence by sentence, re-reading, translating, using cohesive devices, paraphrasing, webbing,* and *using a dictionary*.

The first most frequent strategy was *reading sentence by sentence.* As one of the students, *Mai* (pseudo name), said:

(1) "I read the paragraph sentence by sentence, understand the meaning of each sentence, and then go on reading till the end of the sentence of the paragraph. After that, I look for a main idea of that paragraph." (Mai)

The second most strategy was *re-reading*. One of the students, *Yen*, said:

(2) "I read the whole text more than twice and make inferences by figuring out what the author actually wants to convey the message in the text."(Yen)

The use of these two strategies would obviously be due to the attempts to think deeply the content of the text before making inferences. However, this strategy did not help the students identify the main idea and make an inference.

The third most strategy used by the students was *translating.* In this strategy, the students translated the English text literally (word by word or sentence by sentence) into Indonesian, as seen in the following data:

(3) "I read the text and translated word by word directly so I understand what I read and identify a main idea of a paragraph." (Yan)

This is the common strategy employed by Asian EFL learners. As Liu and Littlewood, in Meyer (2012, p. 246), contrast Western with Asian students' learning strategies, arguing that Asian students incline "to focus on

individual word meanings and grammar points removed from context," while Western students make use of "contextual clues" for comprehension. On the basis of the retrospection (3), there are two plausible explanations why the students used *literal* translation to understand the text. For one thing, this strategy was used because the students tried to understand the exact meaning of each word and sentence and important facts of the text. For another, the strategy was used to identify the main idea since the text is too difficult, or the topic of the text is unfamiliar to the students. Because of the difficulty and unfamiliarity of the text, they had to read the text slowly while translating it if they had not yet understood it. As a result, these impediments make the students unable to identify the main idea and make an inference accurately.

The fourth frequent strategy invoked by the students was *using cohesive devices* such as, *references, word repetitions, synonyms* and *conjunctions.* One of the students stated,

(4) "In order to find out a main idea, first I identify the references which lead us to find out the topic noun and the topic sentence. From the topic sentence, I can identify what the main idea of the paragraph is. As for supporting ideas, I identify sentences which support the main idea." (Her)

References serve a number of purposes. Firstly, they are used to avoid boring repetitions and can provide enriching information about the antecedent (word being referred to). Secondly, they are usually used to connect meaning units and ideas in texts and to present new information in each subsequent sentence. Another cohesive device was *word repetitions.* Like references, the same words might be also often repeated by the author to construct coherence. The next cohesive devices were *synonyms*. The students felt that recognizing the synonym in the text could help them guess the meaning of words in the text and understand the meaning relation in the text.

The fifth strategy used by the students was *paraphrasing*. This strategy refers to readers rephrasing and reproducing the content of L2 text using words in L1 language. There are some ways of paraphrasing chosen by the students. They reproduced some contents, important facts, or just the main idea (e.g., a claim) and supporting ideas (e.g. evidence).One way of paraphrasing was to reproduce some content of the English text by using words in Indonesian, as stated by one of the students:

(5) "The above text describes the movement of the employees. This causes problems . . . The cause is . . . What is needed is . . . On the basis of these facts, we can draw a conclusion." (Eka)

The sixth strategy used by the students was *webbing*. Through webbing, the students are expected to be able to generate key words and to connect them together into a kind of "network" of information in their mind. Farrel (2009) and Sudo and Takaesu (2013) stated that the semantic webbing or mapping could activate students' background knowledge. However, solely webbing strategy did not help the students comprehend texts. This strategy would be effective when it was combined with other bottom-up strategies: *reading sentence by sentence, re-reading,* and *using cohesive devices*, as seen the following retrospection:

(6) "I find out key words related to business (topic). I read all sentences and translate them into Indonesian. Before comprehending the message, I predict the topic of the paragraph and identify its main idea." (Ren)

The data displayed that the student invoked an *interactive process of reading*. First she tried to guess the topic by relating the key words and the topic of the text. After predicting it, she read sentence by sentence (all sentences) and translated them into Indonesian before identifying the main idea. In this strategy, the student obviously made use of the top-down strategy (predicting the topic) and the bottom-up strategy (reading sentence by sentence and translating). However, webbing plus reading sentence, re-reading, and translating strategies did not facilitate the students in comprehending the text in the present study. This finding differed from some previous findings which claim that webbing could facilitate the subjects comprehend the text easily (James 1987; Sayavendra 1993).Yet, one caution for interpretation of these results must be taken into account as it is very possible that the ineffectiveness of webbing to improve the students' comprehension in this experiment is due to the students' low level of foreign language proficiency, and this is in line with the claims that EFL students with a low level of foreign language proficiency may not use reading strategies such as webbing, as good readers usually do when they are reading (Laufer and Sim 1985). It can therefore be claimed that webbing is not effective for the EFL readers with a low level of foreign language proficiency in the present study. The other retrospection also showed the use of webbing plus using cohesive devices, as interactive process, as follows:

(7) "I use a web. First, I predict key words related to the topic of the text. Next, I identify references word repetitions, the topic noun, and topic sentence. Finally, we can recognize a main idea of the paragraph." (Sri)

The above retrospection suggests that webbing is used only to activate the readers' knowledge related to the topic of the text. Having the relevant topic, they could identify the key words which were considered to be related to the references, the topic nouns, and the topic sentences. When webbing was combined with cohesive devices, it was effective. Accordingly, these results strongly confirmed that the cohesion plus webbing strategy could help the students comprehend the text.

The *least* strategy used was *using a dictionary*. This finding reaffirms earlier study (Hulstijin, Hollander, and Greidanus 1996), suggesting that ESL/EFL students seldom use the dictionary when reading a non-fictional text such as academic texts in order to understand the main idea. As one of the students, *Fen*, stated,

(8) "I try to read the whole text in order to get a main idea. Then if I find out some unknown words or vocabulary I try to guess the meanings of those words from the context. I will look up them in a dictionary if I really do not understand the meanings of them."(Fen)

The data showed that the student realized that looking up new words in a dictionary, while reading, would slow down her reading and interrupts her thinking. As a result, she only guessed the meaning of words from the context. However, there are some serious pitfalls in guessing if students' language proficiency is low. Referring to Hynes' study, Celce-Murcia and Olshtain (2000) stated that EFL students could guess the meaning of words accurately only when the context provided them with immediate clues for guessing. If the context clues are not recognized by them because of their low level of foreign language proficiency, they might lead to misinterpret the meaning of words and consequently misunderstand the text. Therefore, students are encouraged to occasionally double-check their guesses by using the dictionary.

Conclusion

The study showed that Indonesian EFL students used more the bottom-up strategies than the top-down strategies. The types of bottom-up strategies used were *reading sentence by sentence*, *re-reading, translating, using cohesive devices* and *using a dictionary*, while top-down strategies were *webbing*. Interestingly *webbing plus sentence by sentence* was also invoked by the students though the strategy was ineffective. By contrast, when *webbing* was combined with *cohesion*, this strategy was effective. Thus, these results may suggest that Indonesian EFL students with a low level of English proficiency rely on their linguistics knowledge when they read economics texts. However, they are ready to be trained to develop their reading strategies if they are given the explicit teaching of top-down and bottom-up simultaneously as the result also revealed that they could employ webbing plus sentence by sentence and cohesion.

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TAILOR-MADE TEACHER STRATEGIES AND PEER ASSESSMENT FOR EFL WRITING

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ABSTRACT

This study aims to find out the impact of a tailor-made teacher strategy for enhancing students' self and peer assessment. Ten students working towards their Master Degree in teaching of English participated in this study. One of the compulsory courses in this programme is Academic Writing. Within six sessions, they were assigned to write drafts of paragraphs within their own subject areas. They then self-assessed their paragraphs following an explanation by the teacher on how to write a good paragraph. Finally, each paragraph was assessed by their peers. In addition, they were requested to complete self and peer assessments. After analysing the data, the results revealed that the EFL students responded positively to the self and peer assessment which was facilitated by a specific strategy designed by the teacher which is contradictory to the argument that most EFL students mistrust feedback given by their peers.

Key words: tailor-made teacher strategy, self assessment, peer assessment, EFL, paragraph writing

1. INTRODUCTION

The role and effectiveness of teacher assessment, self assessment and peer assessment in language teaching and learning, particularly in EFL contexts, remain challenging for researchers and teachers. The principle that underlies teacher assessment is that of a teacher-centred approach; whereas, self and peer assessment form a learner-centred education [1]. It is clear that in teacher assessment, all tasks and procedures are set up by a teacher, but in self and peer assessments, students are involved in not only providing self and peer feedback but also in developing cooperative learning [2].

As procedures in the learning process, self and peer assessments offer some benefits for learners. First, self and peer assessments can develop students' higher-order thinking because they are challenged to be creative. Next, self and peer assessments can encourage learners to collaborate with their peers because they are required to assess and provide feedback to others. More importantly, self and peer assessment may develop learners autonomy because they can prompt students to monitor their own learning.

In spite of their advantages, Nelson and Murphy [3] study revealed that most EFL students prefer teacher assessment to self and peer assessment. This preference may be due to a number of reasons. First, for some decades, teaching methodology in Asian countries, including Indonesia, has exposed students to a teacher-centred education. Next, traditionally the students have believed in the superiority of their teachers [4]. Third, some scholars question whether in typical classroom conditions 'students have the ability to conduct self assessment and use its feedback for text improvement' (5].

A number of previous studies have been conducted in this area. Lam [6] investigated the extent to which self, peer and tutor assessments were related to student perception and text revision. Lam found that EFL learners tend to incorporate both peer and teacher feedback. Thus, he stressed the important role of self assessment in text revision. Zhao [7] investigated the effectiveness of teacher intervention strategies on peer assessment of Chinese EFL writing and found that vigorous and continual teacher support of peer assessment significantly affected learners' perceptions of its value.

However, most of these studies were carried out in ESL and EFL undergraduate programmes, which differ from those of post-graduate programmes in a number of ways, such as the scope, time available and the students' proficiency level. Therefore, a further study is still needed for EFL learners in other contexts.

2. RESEARCH METHODS

Research questions

Based on the review of related literature, the research questions are addressed:

1. Can Indonesian EFL students develop their paragraph writing through a tailor-made teacher strategy and self and peer assessments?
2. What are Indonesian EFL students' perceptions of a tailor-made teacher strategy for self and peer assessments?

Research design

The study which was conducted over seven sessions was designed to develop EFL students' academic writing through a tailor-made teacher strategy and peer assessments. The study aims to find out to what extent a teacher's support can enhance a value of students' self and peer assessment in the writing course.

Research context

There were ten participants who studied in a Master programme at a Department of English Language Teaching in Indonesia. Most of the participants had been English teachers for more than three years; a few were recent graduates with a teaching degree. However, their academic writing was still at below threshold level. They took the course because to write their term papers and thesis in English as a requirement for achieving a Master degree.

Tailor-made Teachers' strategies for peer assessment

Tailor-made strategies are specifically designed by a teacher for the particular purpose of enhancing the quality of peer assessment. These particular supportive strategies for peer assessment include three major essential steps.

The first step is called the activating of students' background knowledge. In the process of activating their background knowledge, the students are requested to select any sentence on any topic they choose and to develop it into a well-formed paragraph by utilizing their knowledge of linguistic tools.

The second step is the developing of the students' knowledge of the concept of writing a good paragraph. In this part, the teacher explains how to write a good paragraph with the goal of providing the students with the concept of paragraph. For example, the teacher describes a good paragraph as having unity, containing one main idea only and should coherence [8]. Next, the teacher instructs students to work in pairs, to assess their partners' paragraphs, and to give direct or indirect feedback to their peers [9]. While the students engage in peer assessment, the teacher walks around and encourages each student to practise assessing and to provide direct or indirect feedback on his/her partner's work.

The last step is revising the paragraphs by referring to the given feedback. In direct feedback, the partner marks errors and provides the correct form; by contrast, in indirect feedback, the partner only marks errors, but the correct form is not given [10], [11].

Instruments

Two types of instruments were employed in the study: paragraph writing and the self and peer assessment questions. The paragraph was composed by students; and self- and peer-assessment, which was constructed by the teacher, consists of six yes/no questions with a space for comments (see Appendix 1).

Data analysis

This study collected two types of data – the paragraph and the self and peer assessment question. The paragraph writing was analysed in order to find out their development of writing skills. To analyse the paragraph, the unity and coherence criteria were used. To see the improvement of the paragraph, the first drafts of the students' paragraphs were compared with the second drafts. The self and peer questions were analysed to see whether the students had positive or negative perceptions of teacher and peer assessment.

3. FINDINGS AND DISCUSSION

Number of revisions made

Ten students' paragraphs were collected and identified with the number of revisions made after self and peer feedback. The results indicated that there were 38 revisions made by 10 students: 20 revisions of the first draft after self feedback and 15 revisions of the second draft after peer feedback.

Out of the number of revisions on the first draft, factually irrelevant supporting sentences were the most frequent errors; no concluding sentence and ineffective topic sentence were the second most frequent; lack of transition signals to link sentences within paragraphs was the third most frequent; other aspects of coherence, such as content and grammar, were the least frequent.

The revision of the second draft after peer feedback revealed that the lack of transition and pronouns was still present. However, other aspects of paragraph unity, such as irrelevant factual supporting sentences, concluding sentences and verb tenses were not significantly problematic.

The result of the revision after self feedback suggests that the effectiveness of a tailor-made strategy for developing students' knowledge of the concept of writing was significant. By understanding the concepts of unity and coherence, they made their own assessment on their own first drafts, and then the experience of self-assessment was used to assess and to provide feedback to their peers. From peer feedback on the second draft, the revisions were relatively minor; and yet, the aspects of content and grammar no longer seemed problematic for the students.

Revision changes

The types of revisions made by the students are classified into the two main aspects of unity and coherence. The former, which is related to the organization of paragraphs, includes the statement of the topic sentence and closely relevant, factually supporting sentences; the latter concerns the use of key noun repetitions, pronouns (references), content and grammar (see Table 1).

Table 1. Types of revisions

Types of revisions	Example no.	First draft	Second draft
Controlling ideas of the topic sentence (unity)	1	There are some reasons why Muslims should learn Arabic. First, Al-Quran is written in Arabic. Consequently, a Muslim has to understand its content. Second, the Prophet, Mohammad, had commended all Muslims to learn. In conclusion, Muslims should learn Arabic to comprehend his or her religion well.	Muslims should learn Arabic for some reasons. First, Al-Quran is written in Arabic. This makes Muslims must have a good proficiency to understand its content easily. Furthermore, the Prophet, Mohammad, commanded all Muslims to learn Arabic. In conclusion, Muslims should learn Arabic to comprehend their religion well.
Irrelevant factual supporting sentences (unity)	2	Graduate students learn quantitative and qualitative research to prepare them in writing journal, proposal, and thesis. The lecturers are very cooperative and helpful because they support their students to ass the course as soon as possible; as a result, the students will begin writing proposal in the first semester. Although writing proposal and thesis needs more effort, the students are motivated to try it.	Students learn quantitative and qualitative research methodology. Quantitative research is confirmatory or "top-down", while qualitative research is exploratory or "bottom-up." A form of final report in quantitative research is statistical report (e.g. with correlations, comparisons of means, and reporting a statistical significance of findings0; nevertheless, a form of final report in qualitative research is narrative report with contextual description and direct quotations from research participants. Both quantitative and qualitative researches are very useful for students in writing thesis.
Key noun repetition, references	3	Teacher, as one of professions, is the most challenging task for me. First of all, we must have much knowledge for our students. Second, we have to be creative in teaching learning process. Next, the teachers have to know many kinds of	Teacher, as one of professions, is the most challenging task for us. First of all, we must have much knowledge for our students. Second, we have to be creative in teaching learning process. Next, we have to know many kinds of methods, many strategies, many materials that used in supporting teaching learning

		methods, many strategies, many materials that used in supporting teaching learning process. Finally, the teacher is like a conductor in concert, who have to make harmony of many different instruments.	process. Finally, we are like a conductor in concert, who have to make harmony of many different instruments.
Content (coherence)	4	West Sumatra has many kinds of famous foods. For example is Rendang. Other example are KripikBalado and IkanBilis. Many people come from other cities who want to know about West Sumatra.	West Sumatra has many kinds of famous foods. First, the famous food is Rendang. Many people like to eat Rendang, even they are from other cities. Also they can make it by themselves at home if they want to eat it. Second, people like to eat "KripikBalado." For example, people who come to West Sumatra like to buy it as their gift to their family and friends. Third, Bilis fish is a delicious fish that comes from Singkarak lake. Many people who want to eat those fish when people come to West Sumatra.
Grammar (verb tenses, subject–verb agreement) (coherence)	5	There are 3 activities in reading strategies. First, reading activities is intended to construct background knowledge, so the students know about a concept or content a particular text. Second is while reading activities. The aims of this stage are to help students to understand the specific content and to perceive the rhetorical structure of the text. The last is post-reading activities. It is intended to verify and expand the knowledge acquired in the reading, and it leads the learners to discuss and analyze issues that presented in the reading. In brief, pre-reading, while-reading, and post-reading are important activities in reading classroom.	There are 3 activities in reading strategies. First, reading activity is intended to construct background knowledge, so the students know about a concept or content a particular text. The second is while reading activity. The aims of this stage are to help students to understand the specific content and to perceive the rhetorical structure of the text. The last is post-reading activity which is intended to verify and expand the knowledge acquired in the reading, and it leads the learners to discuss and analyze issues that presented in the reading. In brief, pre-reading, while-reading, and post-reading are important activities in reading classroom.

In the first example, the first revision type concerns the controlling idea – some reasons – of the topic sentence, which is written in an ineffective way in the first draft: There are some reasons why Muslims should learn Arabic. In the second draft, the controlling idea was revised: Muslims should learn Arabic for some reasons. The revision of the topic sentence makes it easier for a writer to develop the unity of a paragraph, and at the same time it makes it easier for a reader to predict what factual information is being used to support the controlling idea. This finding implies that the students implicitly quiet understand the importance of the controlling idea in a paragraph. This awareness might be due to the impact of self and peer assessment in which students have already learnt the concept of unity and coherence from the peer and teacher.

The second revision is related to the factually supported sentences. In the first draft, the student developed the paragraph with irrelevant supporting sentences. In example two, the student had to jot down specific supporting sentences related to the quantitative and qualitative instead of other facts, such as helpful lectures. But after the tailor-made teacher strategy was conducted, the student was able to develop relevant supporting sentences.

The third revision is the use of key noun repetitions and references to link sentences together. Example three indicates that in the first draft the student employed inconsistent key noun repetitions and references such as, the teacher, the teachers, me, and we. In the second draft, the references us and we are used so that the movement from one sentence to the next is logical and smooth, and, therefore, the paragraph becomes more coherent.

The fourth revision is content. To meet the content criteria, the paragraph adheres to the topic assignment and is thoroughly developed. Example four shows that in the first draft some types of traditional foods are used to explain the controlling idea, which is famous food. In the second draft, several specific and famous foods are developed thoroughly with concrete examples. The data shows the improvement of students' paragraph writing abilities.

The last revision is grammar, particularly the plural forms of nouns and subject–verb agreement. Example five indicates that the student used the singular form, is, for the plural subject, reading activities. Yet, it might happen due to his mistakes instead of errors as seen in the example. He used the correct subject–verb agreement in both the first and second drafts: It leads ... or In brief, pre-reading, while reading and post reading are important activities in reading classroom.

In conclusion, the revisions made by the students might suggest that the tailor-made teacher strategies for enhancing self and peer assessment could develop the ability of EFL students to write paragraphs. This finding is in line with the argument that students should be coerced into a more active through interaction with their teachers, peers and the students themselves [12].

Students' perception of self and peer assessment

The results of the students' perception of self and peer assessments can be summarized as follows:

Most of the students had never been asked to give peer assessment. They commented that by having peer assessment they understood their mistakes. But, two students who had not been asked to give peer assessment commented that up to now the teacher only assessed and provided scores without the involvement of students.

When they were asked whether they trusted their peers when providing feedback, most of them said that they trusted their peers though they kept asking the teacher to correct and check the feedback provided by the peers. A few trusted the teacher because the teacher feedback was clearer than peers. Most of them commented that the teacher feedback was very useful; a few felt it was quite useful.

In short, though most students admitted that they had never been asked to make self and peer assessments, they had a positive perception of self and peer assessment and feedback which is contradictory to the belief that most EFL students prefer teacher feedback to peer feedback because they believed that the teacher had a greater understanding of the subject [13]. Yet it is necessary to note that the educational background of the participants in this study differed from the subjects of Nelson and Murphy's study. The students in this study had BA in English with an intermediate level of English proficiency.

4. CONCLUSION

Self and peer-assessment contribute to the development of students' independence in learning, creative thinking and cooperation. Nevertheless, some researchers remain doubtful of the effectiveness of this formative learning process. This study revealed that the EFL students could, with teacher specific assistance, develop their writing and trust their peers to provide feedbacks. They had also positive perceptions of self and peer assessment and feedback with the understanding

that the teacher continues to facilitate the learning process. Hence, the role of the teacher remains as a facilitator and this motivates students to be active and to cooperate with each other.

This study is limited by the number of participants in the sample as well we by the scope of writing skills to be acquired, Therefore, additional research, particularly in an EFL context, is still needed to arrive at a more comprehensive understanding of the value of self and peer assessment as a formative learning process.

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Improving Junior High School Students' Mathematical Analogical Ability Using Discovery Learning Method

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Abstract

The aim of this study was to identify the influence of discovery learning method towards the mathematical analogical ability of junior high school's students. This is a research using factorial design 2x2 with ANOVA-Two ways. The population of this research included the entire students of SMPN 13 Jakarta (State Junior High School 13 of Jakarta) taken by using cluster random sampling with two samples for each class. In this research, there were two learning groups; one with discovery learning method and the other one with expository. Class VII.6 was used as the experiment group, while Class VII.8 was used as the control group. Each group consisted of 36 students who were divided into three ability scales, namely high, medium, and low. The research data were gained from test, questionnaire, observation, and interview. The result shows that: (1) the improvement of the students' mathematical analogical ability using discovery learning method is considered better than the expository group; (2) There is significant improvement of the students' mathematical analogical ability based on higher, medium, and lower groups.

Key words: Discovery learning method; Mathematical analogical ability

Introduction

Education is at the forefront of preparing competent human resources. It is because education is believed to be able to encourage students to maximize the potential of human resources as a reliable candidate to be critical, logical and innovative in to face and to resolve any problems. This is relevant to the opinion of Sumarmo (2005) which states that mathematics education as a an active, dynamic, and generative process through mathematical activities (doing the math). Those activities provide an important contribution to the students in the development of systematic reasoning, logical thinking, thorough and critical, objective and open in dealing with various problems.

However, the results of The Third International Mathematics and Science Study (TIMSS) conducted on two junior high schools' students in Indonesia against the average math score show that most students achieved only 397 far below the international average which reached 500 TIMSS (TIMSS, 2008) . The value achieved by Indonesian students is also lower when it is compared to some other countries in Asia, such as Taiwan (with an average value of 598), South Korea (597), Singapore (593), Japan (570) and even Malaysia (474). While the PISA 2006 reported that Indonesia ranked 52 out of 57 countries. While the results of math scores on the National Exam, at all units and levels of education are always glued to the low number. At the first time of UN implementation in 2003, the government set a minimum standard for students passing score, which was 3.01, with an average graduation rate of junior high school and senior high school students at 71.55 %. Within several years of the UN implementation at SMP / MTs, the average value in mathematics courses in 2005/2006 is 7.08, with the lowest value of 0.67, and in the year 2006/2007 was 6.92, with the lowest value of 0.33 (Yunengsih, et al . 2008). This indicates that the learning process of mathematics in Indonesia needs to be improved so as to obtain better learning results in mathematics.

The low mathematical ability of students, one of which could be due to students' ability to perform mathematical reasoning is still low. According to the research result conducted by Rahman (2004), it is stated that the initial test results indicate that the ability of students' mathematical analogy are at less qualification. The same statement is also expressed by Suryadi (2005) who explains that the eighth grade students in the city and district of Bandung have difficulty in the ability to argue and find patterns and general forms of testing. Likewise with Herdian (2010), in his research he suggests that the ability of analogy and mathematical analogies of low ability students are at less qualification. The phenomena have happened because the process of learning through

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discovery method has been more difficult for weak students and vice versa for clever students. In addition, Yuliani (2011) has suggested that the ability of analogy and mathematical analogy of the medium and low ability students performed with guided inquiry learning model are at less qualification.

The low ability of the students' mathematical reasoning adversely affects the achievement of the learning. This is consistent with Wahyudin's findings (Herdian, 2010) in a study revealing that one of the tendencies that led to a number of students failure to master the fine points of discussion in mathematics was the lack of using logical reasoning in solving math problems or issues given. The results of Rif'at's study (Suzana, 2003) also showed the weakness in mathematical ability of students seen in the performance of reasoning. For example, errors in mathematical problem-solving by mistake using deductive logic.

Reasoning and mathematics are two aspects that cannot be separated as understood through mathematical reasoning, while reasoning is understood and practiced through the learning of mathematics. This is reinforced by the results of research conducted by Prowsri and Jearakul (Priatna, 2003) that the Thai middle school students perform significant relationship between the ability of reasoning with their math learning outcomes. This suggests that the ability of reasoning plays an important role in the success of students. Those who have good reasoning skills are expected to have a good learning achievement.

According Mundari (2000) there are two analogies, the inductive analogy and the declarative or explanatory analogy. Inductive analogy is the analogy drawn from the principal similarities between two different phenomena. By means of analogy cases, students are trained to see the extent to which they understand the concept and see the microscopic structure of the concept by examining the relationship between the concept of analogy and the case. The cases also open the students' minds about the application or the benefit of studying the concept. Hence, the students can control or monitor their understanding towards something that is being studied and will be aware of the advantages and limitations in learning. As a result, they will find the right solution to enhance their weaknesses in learning.

The method teachers often use is expository method which is used to explain the material and then give the example problems. It was caused by several possibilities, namely: 1) Schools already have props but not yet used optimally ; 2) School did not have props ; 3) The school has had adequate props in terms of places, quality and quantity (Asyhadi, 2005). To develop the mathematical analogy ability, a learning method that has the characteristics to build the category, determine the problem and create a supportive environment is strongly required. The learning method having these characteristics is Discovery Learning. It is based on the discovery learning process described by Veermans (Herdian, 2010) i.e. orientation, generating hypotheses, testing hypotheses, making inferences and evaluation (control).

Ruseffendi (1991) suggests that the discovery method is a method of teaching arranged to make children acquire knowledge that they previously did not already know was not through notification, in which some or all of the knowledge found himself with the help of a teacher. In line with Ruseffendi, Sund (Suriadi, 2006: 5) reveals that discovery is mental processes so that students are able to assimilate a concept or principle. Mental processes are, among others: observing, digesting, understanding, classifying, making allegations, explaining, measuring, making inferences and so on . It is expected that if the students are actively involved in finding a basic principle of their own, they will understand the concept better, remember longer and be able to use it into another context. Blake et. al. (Rochaminah, 2008) discusses the discovery method published by Whewell. Whewell files a discovery method with three stages, namely: 1) clarifying, 2) drawing conclusions inductively, 3) validating (verifying). According to the three stages, it can be seen that the students activeness in discovery methods is needed to put the idea of a mathematical problem. Hence, the students can clarify an issue, then to identify the facts, and finally to draw a conclusion. After the students draw conclusions, they can also prove the truth of the conclusion.

Ruseffendi (Darhim, 2004) also explains that in order to foster a positive attitude towards mathematics, among others is teaching mathematics according to the environment and knowledge of students. The discovery method is one of the progressive teaching methods and focuses on students activities in the learning process. Explicitly Amin (Yuliani, 2011) suggests that a "discovery or invention" activity means a learning activity designed to enable students in discovering the concepts and principles through their own mental processes. In this case, the discovery occurs when students perform mental processes, such as observing, classifying, making allegations, measuring, explaining, drawing conclusions, and so on to find some of the concepts or principles.

While Suryosubroto (2002) suggests that one of widely-used teaching methods these days at schools that has been developed is a method of discovery. It is because this method: 1. It is a way of developing active student

learning; 2. By finding his own, investigating itself, the results obtained will be glued and long-lasting in the memory, not easily forgotten by the students; 3. By discovering themselves, the understanding found by students can be really controlled and is easy to use or to be transferred to other situations ; 4. By using discovery strategies children learn to master one of the scientific methods that will be developed; 5. By this method, children learn to think and try to solve analytical problems by themselves. This habit will be transferred in the real life.

Moreover, Bicknell - Holmes and Hoffman (Herdian, 2010) portray discovery learning using three key properties: 1) exploring and solving problems to create, integrate, and generalize knowledge ; 2) interest -based activities in which students determine the phases and frequencies; and 3) activities that encourage the integration of new knowledge into the prior knowledge base. Discovery learning can be facilitated through a variety of strategies in the classroom. The use of discovery method means teachers try to improve the quality of the students' activity in the learning processes. Hence, the discovery method according Roestiyah (2001) has the following advantages: a) the technique is able to help students to develop, reproduce readiness, as well as master the skills within the students' cognitive/recognition processes; b) the students acquire knowledge that is highly personal / individual, so it can be solid or deep left in the students' memory; and c) It is to increase the excitement of the students' learning.

According Sumarmo (2003), mathematical reasoning includes:1) drawing logical conclusions; 2) providing explanations using models, facts, properties, and relationships; 3) estimate answers and solution processes; 4) using patterns and relationships to analyze mathematical situations; 5) formulating and testing conjectures; 6) formulating opponent example; 7) following the rules of inference, checking the validity of the argument; 8) making the argument valid; 9) arranging direct and indirect evidences and using mathematical induction. Deductive and inductive reasoning can be used to acquire scientific knowledge. Inductive reasoning is a procedure stemming from special events as empirical observations and ends in a conclusion or new knowledge of a general nature. For example, number $4 = 3 \times 1 + 1$, $9 = 3.3$, $16 = 3 \times 5 + 1$, $25 = 3 \times 8 + 1$, $36 = 3 \times 12$, and so on. Based on the events or facts, it is concluded that every perfect square number a2 will meet the form 3k or 3k +1 for all integers k members. From these examples, it can be seen from the facts we can draw a conclusion for the specified generality.

Moreover, Sumarmo (1987) says that inductive reasoning consists of three types: generalization, analogies and causal relationships (cause and effect). Inductive reasoning involves the perception of regularity. Regularity is seen for example in drawing conclusions from the cases of a special nature then finding patterns/rules underlying or in obtaining the similarity/likeness of different examples. Inductive reasoning is divided into 3 parts, namely generalization, analogy, and causality. The analogy is used to compare two different things based on likeness. Besides finding the similarity between two different things, the analogy also draws conclusions on the basis of the similarity. Thus, the analogy is used as an explanation or as a basis for reasoning.

According Mundiri (2000), there are two kinds of analogy, namely inductive analogy and declarative or descriptive analogy. Inductive analogy is an analogy which is based on a different principle of equations on two phenomena. It can be further concluded that what is contained in the first is also the phenomenon of the second one. The analogy of declarative or descriptive is a method to describe something that is not known or is still vague, using terms that are already known. Suherman (2001) explains that the roles of mathematics at schools are: 1) to prepare students to be able to face changes in life circumstances in a changing world, through the practice of acting on the basis of logical thinking and rational, critical and careful, objective, effective, and synthetic analytically calculated; 2) to prepare students to use mathematics functionally in everyday life and in coping with other sciences.

In addition, Sumarmo (1987) also gives an overview of indicators to measure reasoning ability analogy, namely: a) Students can observe the pattern (from a picture or a number); b) Students can determine the relationship between the patterns of the images or numbers; and c) Students can estimate the proficiency level rules that make up the patterns. The mathematical analogy in understanding the ability of this research is the process of drawing conclusions on the basis of similarity by comparing two different things. The conclusions are drawn from the similarity so that they can be used as explanatory or as the basis of reasoning. Analogical ability should fulfill the indicators: Students can observe the pattern (from a picture or a number); students can determine the relationship between the image patterns or numbers; and students can estimate or predict proficiency level rules that make up the pattern.

Method

Samples in this study were the seventh-grade students of State Junior High School 13 Jakarta as much as two classes, namely classes VII.6 and VII.8 with each class selected 36 students as the samples. The reason for the selection of the sample was because they were considered to be able to adapt to the new learning (other than usual) and they did not interfere with the school program to prepare the national examination. The grouping of the students was based on mathematical skills according to the previous learning math results (from daily and midterm tests) as well as the classification done by the class teacher. The division of the student ability was divided into three different groups categories, namely higher, middle and lower, respectively 30%, 40% and 30% (Dahlan, 2004).

The results of grouping categories of students in the experimental and control class capabilities were the same, namely 11 students included in higher category, 14 students included in middle category, and 11 students, included in lower category. The design which is used in this study is "factorial design" which takes into account the presence of the control variables that affect treatment (independent variable) on the outcome (dependent variable). This study was conducted on the students of the two classes chosen with particular consideration. The study design is in the form:

A O X O
A O O

where : O : pretest posttest (testing the students' mathematical abilities analogy)
X : Treatment of learning by discovery method

This study used a 2x1x3 facorial models, where 2 is the number of learning factors (method of discovery learning and expository teaching methods); 1 factor is the number of students' mathematical ability (ability of mathematical analogy); and 3 is the number of students' initial ability (high student, the student is and low student).

Results and Discussion

The data in this study were obtained from the pretest scores, as well as data scale showing the students' attitudes toward math. Pretest scores are used to determine the ability of students before being given treatment, whereas to see the improvement obtained from the difference between pretest and posttest scores as well as analogy and capabilities ideal score of mathematical students analogy expressed in normalized gain scores. The following is a statistical description of the scores from pretest, posttest, and normalized gain (g) in the form of a table.

Table 1. Descriptive statistics of mathematical analogy ability scores

Mathematical Analogy Ability		N	Minimum	Maximum	Mean	Standard Deviation
Experiment	Pretest	36	2.00	15.00	8.2222	3.67315
	Posttest	36	8.00	19.00	15.2778	3.36886
	Gain	36	.20	.89	.6308	.19009
Control	Pretest	36	1.00	14.00	8.2500	3.21047
	Posttest	36	6.00	19.00	13.9167	2.94109
	Gain	36	.18	.88	.4925	.16712
Ideal Score				20		

Mathematical Analogy Ability Pretest Results

To identify that the initial ability between the experimental and control classes is not significantly different, the analysis of mean equality results test of the pretest is conducted. The steps that should be taken to conduct mean similarity are by doing the tests of data distribution and homogeneity of variance. If the data met the requirements of normality and homogeneity, the mean equality test is t-test; whereas the data are not normal, the non - parametric test is used.

Table 2. Mean similarity test of students' mathematical analogy ability pretest

Mathematical Analogical Skill			t	dk	*p-value* (2-tailed)	Kes.
Pretest	Variance Assumption	Similarity	-.034	70	.973	Terima H_0
	Variance Assumption	Difference	-.034	68.768	.973	

Results of Normalized Gain Mathematical Analogy Ability

By using SPSS 16 for Windows, the statistical description of the data obtained and the normalized gain mathematical analogy capability is as follows:

Table 3. Descriptive statistics gain mathematical analogies ability normalized according to the method of student learning and capability category

Students' Initial Skill	Statistics	N-Gain			N-Gain Mean Difference
		MPD	MPE	Total	
High	Mean	0.7136	0.5555	0.6345	0.1581
	Std. Dev.	0.17557	0.13560	0.17317	
	N	11	11	22	
Medium	Mean	0.6836	0.5229	0.6032	0.1607
	Std. Dev.	0.17557	0.13560	0.17674	
	N	14	14	28	
Low	Mean	0.4809	0.3909	0.4359	0.0900
	Std. Dev.	0.18273	0.14896	0.16908	
	N	11	11	22	
Total	Mean	0.6308	0.4925	0.5617	0.1383
	Std. Dev.	0.19009	0.16712	0.19087	
	N	36	36	72	

Hypothesis Testing

The normalized gain of both experimental and control classes has a homogeneous variance and normal distribution. Then, the gain value is used to determine the significance of differences in mean of both groups by using two-path variance analysis (ANOVA). This analysis was conducted to see the direct influence of two different treatments given to the ability of students based on mathematical analogy learning methods and categories of students' abilities. The results of analysis of variance test calculated using SPSS General Linear Model 16 solid (GLM) performed at significance level $\alpha = 0.05$, while the summary is presented in Table 4.

Table 4. Normalized capability analysis of variance gain mathematical analogies according to methods of learning and student ability category

	Square SUM (JK)	Dk	JK Mean	F	*p-value*	Conclusion
Learning	.330	1	.330	12.737	.001	Tolak H_0
Students' Skill	.513	2	.257	9.899	.000	Tolak H_0
Learning * Students' Skill	.019	2	.009	.357	.701	Terima H_0
Mistakes	1.711	66	.026			
Total	25.300	72				

Furthermore, based on the table in above, the research hypothesis testing was conducted. The hypothesis to be tested is as follows:

Hypothesis 1:

Criteria for testing H0 is rejected, if Asymp.Sig (1 - tailed) is < α = 0.05. According Widiarso (2007) test the relationship significance values and two one -way direction of the output is Sig .(1 - tailed) = 1/2 Sig .(2 - tailed) . After calculating the two- lane ANOVA results can be seen in Table 4. Retrieved sig. (1 - tailed) of 0.0005 < α = 0.05 . Therefore, the result is the null hypothesis is rejected, it means an increase in the ability of students receiving mathematical analogy with the method of discovery learning is significantly better than the students who received learning with expository method. So it can be said that learning learn with discovery methods contribute significantly to the improvement of the ability of mathematical analogy.

Hypothesis 2:

Criteria for testing H0 is rejected, if Asymp.Sig (1 - tailed) < α = 0.05 . After calculating the two- lane ANOVA results can be seen in Table 4:21 . Retrieved sig. (1 - tailed) of 0.000 < α = 0.05 . Therefore, the result is the null hypothesis is rejected. It means that meaning that there are differences in students' mathematical analogy upgrades seen from the category of high –ability students, medium, and low.

Discussion

The learning activities administered using discovery method to discuss materials about triangle, square and rectangular was considered a new way for students. It can be seen when most students answered the interview sheet by stating that the use of discovery methods prepared by teachers was a novelty because the learning had not previously been done. They also felt happy with the learning that had been done. Their reason was that by the methods they learned and practiced using the props like origami paper and HVS paper. According to the students, they had been studying while practicing more easily because by using the method they could directly see the object and then concluded it through the easy questions existing on the worksheet (Students Worksheet) which had been provided by the teacher.

In addition, because the discovery learning method was done in groups, collaboration or interaction between students could run well. However, at the beginning of the learning at the first meeting it did not run smoothly. It was because there were some students who did not want to be divided into groups with a particular student. Consequently, the teacher gave the student chance to choose which group he/she intended to exchange with. Finally after the second and subsequent meetings they could interact with their peers smoothly.
Moreover, through the interaction between groups, they could express their opinions to solve a given problem in the worksheet. They also felt happy because they could ask friends about subject matters they did not understand yet and they also could work together. By the cooperation among students, the presented problems could be resolved easily and effectively. Problem solving activities also stimulated the group's mental activity in finding concepts, procedures and principles of mathematics which were heavily dependent on the questions presented in the student worksheet. As a result, the questions posed should encourage students to make the process of conducting analysis, finding analogies, and making generalization.

In addition, by learning with discovery methods students were given the opportunity to explore the material by using a tool such as origami paper. By using tools like the example, the students could identify the area of a triangle formula by folding paper to form a triangular shaped rectangle. The students, then, concluded that there was a relationship between the broad formulation of a rectangle and a triangle area formula. Then the students discussed how the relationship between the formulation of the broad rectangular area to the area of the triangle is. The activity greatly assisted students in understanding the concept to make identification and then draw conclusions.

Guidance by the teacher in the learning with discovery method was given in questions forms existing within the worksheets or during learning teacher walked around in each group to monitor and provide reinforcement (scaffolding) when the students asked questions. Consequently, the need for the didactic pedagogical anticipation should have been made in the lesson plan before the learning process was carried out. Prior to the learning process was to identify students' predictions of response to the problem which had been available in the worksheet. Anticipation is very helpful didactic pedagogical aspect when there were some students' responses were appropriate to the prediction. As an example, in the study of the properties of a square where the students were provided with two rectangles that had different sizes, then the students were asked "Are there any similarities and differences between the two pieces of the square? ". In this case, the anticipation is that the researcher had made no difference response prediction that the two long sides of a square were different and had

in common, but two rectangular had the same side's length and the same angles, which were 900. In the learning process, the students took measurements and formed angles side. Then the students were asked the same questions and answered that both shapes had the same the same side length but different shapes had different lengths. Based on this response, prediction had been made equal to the students' answers.

However, there were also findings revealing that researcher had not made prediction, for example in the material about the triangle. The worksheet presented some questions to find the area of a triangle with a broad approach towards rectangular areas. In the worksheet, the students were told to make any triangle, then folded paper into triangles then formed a rectangle. There was one student made a right-angled triangle and an isosceles, but it was formed into a square, not a rectangular. Then, the researcher asked the students about the concept of square and rectangular. The student answered that square and rectangular was different if the same square sides and rectangles were not the same. Then the researchers asked the students to continue their activities and obtain the final conclusion that the area of a triangle is $1/2 \times t$. The finding indicates that the students' activity in learning by using the method developed the discovery into the ideas of students. There is freedom of thought to remove the idea of rigid learning. By the students' freedom of expression, they can easily observe and identify problems contained in the worksheet so that they could integrate a generalization or conclusion.

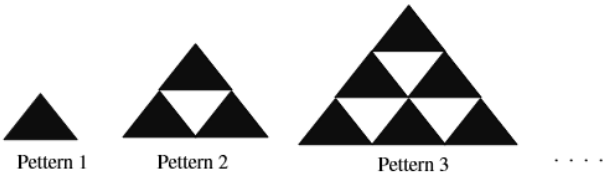
In constructing mathematical concepts either individually or in groups through the process of analysis, analogies, and generalization, students should receive help from the teacher. Assistance provided may form the questions that are simpler and more direct for the students to construct a mathematical concept. Discovery will become an effective learning method when the questions in the student worksheet are presented appropriately so that they can stimulate students' thinking process optimally. It means that the questions in the student worksheet should encourage students to make the process of discovery. The students' success or failure to discover concepts, procedures and principles in mathematics also depends on the shape of the questions posed orally by the teacher during the learning process. The questions posed should be able to be covered by the student's mind. This is in order not to make the students fail in finding the concept. It is aimed to make students not to feel frustrated, which can lead to them losing the spirit and confidence in finding mathematical concepts.

Based on data analysis, it can be concluded that learning by discovery methods significantly enhances the ability of mathematical analogy and generalization compared to the control group that received expository. The enhancement was based on their activities in the full meaning of learning by discovery methods so that students could understand the concept of mathematical analogy and generalization more easily. This is in accordance with the opinion of Bicknell-Holmes & Hoffman (Castronova, 2006: 2) about three main properties of discovery learning: (1) explore and solve problems to create, integrate, and generalize knowledge. (2) an interest-based activities where students set the stage and frequency, and (3) activities that encourage the integration of new knowledge into the prior knowledge.

The success of learning by discovery methods in enhancing the ability of mathematical analogy and generalization occurs because students conducted thinking processes, measurements, and observation towards the facts that existed then analyzed the facts and then drew conclusions. Students reacted with efforts to build meaningful patterns from the observations of others. As a result, students will stay longer given the concept of learning materials. This is reinforced by the opinion that discovery method has virtues as revealed by Suryosubroto (2002: 200) that this method helps students develop or augment supplies, mastery of skills and cognitive processes of students, student suppose it continues to be involved in the guided discovery. Knowledge gained from this strategy is very personal in nature and may constitute a very solid knowledge, in the sense of deepening the understanding of retention and transfer.

There are findings in the learning process where students generalized an activity to practice more easily as an example in the materials circumference and area of a rectangle in which students used the HVS paper then divided the sides into a two-centimeter lengths and then connected the dots marks so as to form squares. Connect young students with a number of the circumference or area of a rectangle is that $K = 2 (p + l)$ and $L = p \times l$. Things practical activities with the help of the tool is very helpful in the generalization process, which in the context of the students found facts, then students integrate into a knowledge so gained generalization process.
However, students had difficulties to determine the pattern of all n if the problem is patterned. Such examples expressed when a triangle was arranged as follows:

How many triangles are shaded in a pattern to-n? There was one of the students who enrolled by arranging patterns of numbers 1, 3, 6, 10, 15,. , , ., He found that every first term was added to the 2, 2nd rate plus 3, 3rd rate plus 4 onwards but could not conclude the n. To help the student, the researcher provided scaffolding to students by having students create a label just as below:



pattern 1 = $\frac{1\times 2}{2}$

Pattern 2 = 3 = $\frac{2\times 3}{3}$

pattern 3 = 6 = $\frac{3\times 4}{3}$

pattern 4 = 10 = $\frac{4\times 5}{3}$

. . . .

From that data the students found a link between the numerals pattern with the next number multiplication then divided by 2 so the students could make a conclusion that the number of triangles shaded in a pattern to-n was $\frac{n(n+1)}{2}$. The student will more easily be able to find a pattern to show the linkage of existing numbers but teachers must continue to guide and provide scaffolding. Based on the analysis of pretest scores of the experimental and control groups, it is showed there was no significant difference. Furthermore, the two groups were given different treatments. The experimental group was treated with the method of discovery learning while gaining the control group learning with expository method. Based on normalized gain calculations, the experimental group showed significant mean increase in the ability of the control group analogy of 0.631 while the average for the control group mathematical analogy Based on the value of 0.493 ANOVA test, it is obtained significance Two Line 0.001 < 0.05, which means an increased ability to obtain a mathematical analogy of learning by discovery method better than those gained by learning expository method. Overall increase in normalized gain abilities that students acquire mathematical analogy with the method of discovery learning with students receiving learning with expository method are at moderate classification.

From the calculation results also, it is also shown that the performance improvement gained mathematical analogy with the method of discovery learning is better than students who received the expository learning. Moreover, Suryosubroto (2002, 191) suggests that one method of teaching these days widely used in schools that have been developed is a method of discovery. This is because this method enables students to find their own meaning which is found quickly and easily used or transferred in any other situations. That is to analogize with the condition can make students easily to connect mathematics with material in other situations on the basis of a same - similarity principle or nature. In addition, the discovery stage of learning where students formulate principles and generalizations belong to the results of his findings (Suryosubroto, 2002). Hence, the students can deduce the material from the two similarity analysis which is presented in terms of student worksheets.

ANOVA statistical test is then performed two tracks to see differences in mathematical analogy seen an increase in the ability of the student's ability category. The test results indicate a rejection of H0 of the difference increased ability students 'mathematical analogy, between high, medium and low students' ability categories. It is shown that students indicated that significantly affect students' mathematical analogy upgrades. This is in line with the opinion of Galton (Ruseffendi, 1991) that there is a child of a group of some gifted children will be smart, moderate and less, which has the capability of individual differences. Problems frequently occurring in mathematics learning usually occur in less or low capable students. They tend not to follow the lessons as quickly and as best math students were much less capable of high rate capability. So, the learning process takes a slightly different treatment in the group of students who are less capable. Teachers should be more patient guide and inform any perceived lack of understanding by the students.

With the discovery method these problems can be minimized because the students who are grouped into low-ability students can exchange ideas with other students who have moderate or high ability students' understanding so that obstacles can be overcome. This is in accordance with the opinion of discovery method according Roestiyah (2001, 20) who states that discovery method has the following advantages: a) the technique is able to help students to develop, reproduce readiness, as well as in the process of cognitive skills mastery/recognition of students; b) students gain knowledge that is highly personal / individual that can be solid or deep left in the soul of the student; and c) to increase the excitement of the students' learning.

From one of the observations at the first meeting to discuss the properties of triangles, students make observations of three triangles presented in LKS is an equilateral triangle with different sides different length. Students measure the length of the sides and angles major students can immediately conclude that the three triangles of the similarities and differences that have formed the third corner of the triangle is the same result that is 600 and the three pieces of the triangle have the same side. Then the students also found no difference in the three pieces of the triangle is the length of each side is different. After the student in question and what the terms say equilateral triangle? There are students who answered the same answer corners and there are students who answered all three sides equal. Thus, the ability of an analogy that is concluded on the basis of two kinds of situations students can run well.

However, from the findings of the students also have difficulty in concluding on the basis of similarity when students are faced with issues of material about the story about the circumference and area of a triangle. The difficulty is to link students to the elements of the problem and then find a solution to the first problem in the same way so that students can solve the problem on the second issue on the basis of the same way in the completion of the first problem. From these findings the researchers provide assistance on how to resolve the problem about the story on the circumference and area of a triangle by giving some problems. Then, after the students understand how to solve the problems of the story circumference and area of a triangle given the students about mathematical analogy contained in the worksheet and the students can identify problems and can solve the problem with the analogy to include what is used in solving the problem. It is within their opinion of Vygotsky (Muhammad Nur , 2004) the level of knowledge or knowledge of this cascade by Vygotskian describes as scaffolding that means giving to a large number of individual assistance during the early stages of learning and then reduce the effort and give the child the opportunity to take over greater responsibility as soon as able to do alone.

According to the average gain is equal to 0.630 normalized, there are 14 students or below the average of 38.89 %. Of the 14 students, there are 11 students and 3 low-ability students are capable of being. This means that the discovery learning method was effective to improve students' mathematical analogy. However, there are shortcomings in its implementation such as the low-ability group of students who have difficulty in understanding the problems that exist on the worksheet. Besides, the students feel that there are problems in the worksheets so much that they cannot resolve all the issue contained in the worksheet. Besides that, it can be observed that the activeness of low ability students performed less when compared with students who have high or moderate capability.

The difference between the average normalized gain initial ability students showed that the higher the initial ability of the students the higher the increase in the ability of students' mathematical analogy. Which means that the students' initial ability is indispensable in learning. Since the beginning student a good ability of the material before the student can construct a new concept with its initial capabilities. Judging from the average normalized gain mathematical analogy capabilities in the category of high prior knowledge students acquire learning by discovery method is higher than the high- ability students, medium and low student to acquire learning expository method. This was due to the students' learning by discovery method presented a problem and the students themselves who determine the solution. In determining student solutions using tools so that they can identify directly the problems presented so that students can easily determine the solution.

When viewed from the difference in capacity building mathematical analogy, the largest difference occurs between the student is capable of learning was 0.161, high- ability students at 0.159 and 0.090 lower ability students. This is to indicate a that the application of the MPD is better than the MPE application in improving the ability of students 'mathematical analogy and students who have prior knowledge were greater benefit in improving the ability of students' mathematical analogy. It shows that students who experience learning was enabled by the discovery method can follow the lesson well. This is due to the clustering that is within a group of students are capable of high, medium and low. Hal shows the interaction between the student to determine the patterns of thought can go well. This is in line with Vygotsky expresses the opinion that in the four major principles such as Slavin (Muhammad Nur , 2004) is a social learning , ZPD (zone of proximal development) ,

cognitive apprenticeship and learning mediated) . The essence of this theory is the emphasis on the interaction between the internal aspects of learning and emphasis on learning environment.

Conclusion

Based on research data and data analysis results, it is obtained some conclusions related to the research hypotheses, among others: 1. The increased ability mathematical analogy of the students who received learning methods discovery is better than the students receiving learning with expository method. 2. There are differences in students' mathematical analogy upgrades seen from the categories: a) the group of high- ability students; b) a group of students capable of being; and c) low-ability groups of students.

Recommendations

Based on the research results, it is obtained that the research recommendations are presented, among others, as follows: 1) Prior to the discovery learning method where the students in the group will create, within a group of students who are capable should be high, medium or low. This is for the guidance of activities undertaken by teachers to be more effective because the students having high or moderate ability will to help low-ability students, 2) The use of learning tools to make learning more meaningful so that the geometry of the material should be presented with the help of props. 3) Before using the discovery method, it is better for the teachers to identify the students' ability. It is aimed to create a condition where high and moderate students will help the low ones. 4) The students' analogical skill of junior high school students needs appropriate scaffolding by integrating it with the geometry shapes' presentation. 5) The learning materials in discovery method should be made after conducting pedagogical didactic analysis by connecting them to the analogical skill's obstacles on geometry lesson. 6. To develop the analogical skill in geometry, teachers can use algebraic patterns to present geometry shapes because junior high school students understand more about them.

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Self-Conception of The Vagrants in Jakarta

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Abstract

This research aims to identify the self construction and communicating acts amongst the vagrants while doing their daily activities as vagrant in Jakarta. The method used for this research was a qualitative method with phenomenologist paradigm which aims to understand human behaviors from an experimental subject perspective. The observation used an in-depth interview technique as well as participant's observation technique. This study is known as an emic study to further identify self construction based on ideographic analysis which aims to give a brief description regarding self communicating acts among vagrants. Result from this analysis will not be quantified nor generalized with other cases. Result shows that vagrants, especially those who have the same profession, tend to share the area of work in order to avoid conflicts among them. Description from the subject in establishing communication with other vagrants is done by sharing area of expertise from himself and other vagrants. Results also showed that almost all the subjects tend to close their "darker" side from others who don't know that they are vagrants by impression management. These people came into existence not only because of a poor culture which shows nomadic type of living habit, but it's also because of the structure and vast majority which sees them with a negative stigma for every type of occupation they choose including a forced action because they were left without any choices other than being a vagrant.

Abstrak

Penelitian ini bertujuan untuk mengidentifikasi pembentukan konsep diri tunawisma saat mereka melakukan kegiatan sehari-hari mereka sebagai tunawisma di pusat kota Jakarta. Metode yang digunakan untuk penelitian ini adalah metode kualitatif dengan paradigma fenomenologi yang bertujuan untuk memahami perilaku manusia dari perspektif eksperimental. Hasil menunjukkan bahwa tunawisma, terutama mereka yang memiliki profesi yang sama, cenderung berbagi wilayah kerja untuk menghindari konflik di antara mereka. Tunawisma juga berbagi bidang keahlian satu sama lain. Hasil menunjukkan bahwa mereka menutupi sisi "gelap" mereka dari orang lain yang tidak tahu bahwa mereka adalah gelandangan melalui manajemen kesan. Orang-orang ini muncul bukan hanya karena budaya miskin yang menyebabkan mereka hidup nomaden, tetapi juga karena struktur dan mayoritas yang melihat mereka dengan stigma negatif untuk setiap jenis pekerjaan mereka pilih. Mereka juga menjadi gelandakan karena terpaksa, tidak ada pilihan lain.

Keywords: *phenomenology; vagrant; qualitative*

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INTRODUCTION

The emergence of the vagrants in urban environment is a symptom of social culture which relatively catches the attention of various parties, no exception for researchers. In general, the rise of the vagrant appears simultaneously with the development of the urban environment, in line with the needs of workers, a cheap labor in supporting the process of growth and development of the city. The occurrence of the vagrant generally come from rural communities who migrate to the city to seek their fortunes, to seek more decent jobs and receive enough commission to change his life in the countryside.

Jakarta as the adequate and sufficient seat of government, economy and other social amenities can motivate and inspire someone to come and try to snitch his/her fate in hope of getting a decent livelihood rather than in the village. As recognized by Iswandi in the interview done by Trans 7 in the show "Gerobakku Harapanku[1]" that he came to Jakarta to try to seek his fortune in hope that he could get a job, decent and better income, but having arrived in Jakarta he can only live as a vagrant with his wife and one daughter draping their lives by going round as a street scavenger, picking up garbage on the streets and housings.

Based on the exposure and the description above, a research on the life of vagrants is interesting to do because it is not only to uncover subjective reality of the one who enters the world of vagrants but also to reveal the negative image and cultural construction that is considered deviant and treatment experienced by the vagrants in their activities, in a certain area and limitation that makes them have a way, value and tradition of a culture that is different from the others. Vagrants re-interpret their behavior from normal people's objectification to be able to live together with them. Vagrants expect the public to give them legitimacy of their attitude, and do not want the people to thwart their struggles and existence.

Theoritical concepts of symbolic interactions can guide researchers to depict from the reality description and the portrait of vagrants phenomenon in Jakarta. Social life in the view of the symbolic interaction means a human interaction by using a symbol that is always used by people to communicate and interact to each other. In these interactions also occur efforts to define and interpret to each other between one action with the other in negotiating the exchanged meanings. Self or the self conception in the view of Mead (in Mulyana: 2004: 73) is a process that comes from the individual's social interaction with other people, or the other definition, the self is also a "social object" which we share to other people in an interaction (Soeprapto: 2002: 204).

Thus, the self conception of every individual is largely determined by how others see/assess themselves when interacting. Cooley (in Mulyana, 2002: 74) said that the self conception of the individual is significantly determined by what he/she thinks about other people's thoughts about him/her. Therefore, if this theory (symbolic interaction) as one perspective (the theory) for ' observing ' the reality of vagrants' communication, it will be very precise and exciting. Moreover, the theory of symbolic interaction has become one of the perspectives in communication studies (Littlejohn, 1996: 159).

The social construction of deviant behavior/*devians* play an important role in the process of labelling occurred in the community. This process not only involves a labelling of *devians'* criminal behavior that do not conform to social norms, but also reflects stereotyping and stigmatization of deviant behavior. Vagrant is a social group that is regarded as a person who is considered to be deviant. Even often, feeling suspicious as well as contemptible, trifling, and sordid identical to taking possession of another person, causing vileness, cunning and causing crime. A label or a nickname will always be carried as long as they choose to live as homeless people, who certainly will organize, act, and be alleged to behave according to the self image gained from the social groups who are not from the community. At the same time it will also set up a

1 "Gerobakku Harapanku" Trans 7, Jum'at 12 Februari 2010

system of communication and interaction with the community outside the homeless community. As Mulyana (2004; 173) said that the insistent definition of others will replace their self-image even though it was originally at odds with their wishes. The impact of labelling is more powerful when it is also disseminated by the press especially if the labelled ones are commoners.

In an effort to present themselves, sometimes the actor is facing various problems about his/her "self" among for example about self-image he wants other people to see, with the actual identity, especially the self-image has a stigma (disabled), whether it is physical or social stigma. In the case of physical stigma, the actors assume that the audiences know that the actors are physically different to them, whereas in the case of social stigma, the audiences do not know and see it. If seen from one of the studies about self presentation then this question would be more appropriate to make dramaturgis theory as part of the theoretical review. Dramaturgis approach Goffman specifically centers on the view that when humans interact with each other, they would like to manage the impression that they are expected to grow in others toward them. To that end, each person performs a show for others (Mulyana, 2001: 107), so this life according to Goffman is like an acting stage. By following this theatrical analogy, Goffman talks about the *front stage* and the *back stage* (Ritzer, 2004: 298).

METHOD

This research used qualitative research methods with the phenomenological research tradition. In terms of Lindlof (1995: 27), it is called as the interpretive paradigm to refer to communication research with qualitative method which performed the tradition of Phenomenology, symbolic interaction, etnometodologi, ethnography and cultural studies. Creswell (1998: 14) says that the qualitative research is a research whose background, location and time are natural. This paradigm also allows a qualitative interpretation on the research data that has been retrieved. In addition, this research will provide a great opportunity to establish the alternative interpretations. Mulyana (2004) mentions this qualitative research as a subjective perspective.

As the general phenomenological tradition explains the meaning of life experience of a number of people about a conception or symptoms (Creswel, 1998: 51), this research will also attempt to describe the life experience of the subject (vagrants), using biographical studies to trace the life history of the vagrants. One of the characters of phenomenological qualitative research is conducting an observation and interaction with the subjects of research to try to understand their language and interpretation of the world. Things like this are also emphasized by Creswell (1998: 14) that qualitative research is a research whose background, location and time are natural. This paradigm also allows a qualitative interpretation on the research data that has been retrieved. In addition, this research will provide a great opportunity to establish the alternative interpretations (Littlejohn, 1996: 16).

RESULTS AND DISCUSSION

Vagrants' Self Image

The perception or assumption of the research subject about their physical, psychic and social conditions which indicate them as the vagrants that have negative self conception will be described in detail. An explanation of the subject's view toward all physical things is meant as a subjective perception of communication behavior presented based on thier views about physical appearance, attributes used in conducting interaction and doing their professions. In a subtle behavioral communication initiated by the subject can be seen when they are wearing their attributes and their daily behavior. The results of the study at least found some activities carried out by the subject in this study that show the physical characteristics that characterize their identity such as a dirty and dishevelled appearance, using wagon

as a place to live, means of transportation and working, disordered eating, and health problems.

Related to the behavior or psychological perception of the vagrants, some of the behaviors shown are withdrawal, leaving the religious devotion, feeling inadequate, lazy and manipulation of goods (lying) as for the social tendency is by avoiding social contact, violation of the norms and ethics of society.

In general, a positive self conception is seen in some of the psychological behaviors shown with optimistic attitude, confidence and always have positive attitude toward everything even failures. Failures are not looked upon as death, but rather making it as a discovery and a valuable lesson to step forward. People with a positive self conception will be able to appreciate themselves and to see the positive things that can be done for the sake of their success in the future. Subject informant in the category of the homeless that has positive physical self conception generally expressed the idea energetically and showed a cheerful face. Although he seemed to be physically tired and exhausted due to a long day of walking and vagrancy looking for second-handed goods and pulling his wagon.

Vagrants' Typology

Based on a wide range of views and opinions of the research subjects about various things are both regarding to him and about other people and the environment. From my observation about the phenomenon of vagrant families' daily activities, so the researchers can make some typologies toward the research subjects namely: optimistic vagrants, pessimistic vagrants, and conditional vagrants.

On the typology of pessimistic group, the vagrants with this label and typology show more attitudes that are not passionate to live their lives and to select the profession as an alternative job. They tend to be moody, inferior, fantasizing, and choosing to work as a beggar. The research subjects like this usually have a negative physical, social and psychological perception, and also live his life pessimistically. Even inspite of their posture and their young age, they manifested themselves as slackers. In religious term, the research subjects in this typology do not look like to do praying activities.

The term of optimism for this second typology is judged appropriate given the subject of the research included showing an energetic attitude and demonstrating a sense of optimism and it is very visible on their enthusiasm to transform their lives, especially in term of earthly business. In the discussion, they still show the good quality contents of the speech, systematic way and delivered enthusiastically whereas conditional vagrants' typology has several traits that arise when interacting with the outside world. In the categories they consider their jobs as a scavenger and nomad because it is to increase mobility and expand of the coverage of the areas that can be considered to have a lot of opportunities to pick up good items.

In addition, the topology of the subjects that have this character has the habit to respond and be perceptive about the opportunities to get a lot of results and they also have no intention to try to find additional money by being a beggar. However, they are very responsive to the environment outside especially if there is information on the activities of the authorities. They are always prepared to immediately avoid them so they will not be arrested.

Motivation and Career Option of the Research Subjects

Based on the research results through in-depth interviews and observations, the depiction of the motive or the reason of the subjects in this study is obtained. They are: 1) about poverty (economic term); one of the motives described in the results of this research is that poverty or unability in economic term became the motivation for someone to become a vagrant, 2) about family (family matter), another issue encouraging and motivating a vagrant in this research subject so that the vagrants are getting rampant in Jakarta is not only concerned about poverty and economic problems, but also social and cultural problems.

A typology of the vagrants who have a profession as a beggar is generally performed by a group of seasonal vagrants who come to Jakarta during the fasting month and Idul fitri holiday. However, nearly half of the research subjects acknowledge that they actually become a beggar although packed with a wagon or cart as the attribute or accessories to provoke people to feel merciful, especially for car drivers and motorbike riders.

The Impression Management of Vagrants based on Communication "Setting"

In the writing of this study, researcher divided subjects' acts as a communication behavior that based on the impression management based on communication setting by the way of choosing the time, area and work divison as a social setting and communication setting. 1) By doing activity based on the time setting, based on the results of research, observation and in-depth interviews conducted with all the subjects in this study, the information and representation regarding the conception and consideration about time as a consideration when the subject are working to pick up second-hand goods were obtained. The subject in this study realized very well that knowledge of planning time will not only have an impact on the results obtained, but also closely related and intertwined with the interaction and communication with others. 2) Working based on area selection; the daily work of the vagrants as the subjects in general is a scavenger, i.e. collecting used goods for sale or using them. For them, there is not any main location as a target because second-handed items can be obtained anywhere. Based on the interview with the research subjects, places that are believed to have more resources and quality than other locations were obtained. A wide variety of their working areas that researcher had found that is frequent and often visited by the subjects that use carts in their activity of picking up the second-handed items are streets, market area, residential area, social facilities such as hospitals, schools, etc, and public garbage containers. Places that are believed to have excess resources will in turn be controlled by particular vagrant so that there is a guarantee for the income continuity for him/her in the future. One of the tactics put into practice was to give a sign, i.e. with a wagon/cart parked near the garbage container.

Vagrants' "Self" Management toward Communication Partner

Interactive communication and self presentation performed by the subjects in this research were at least done with several communication participants that each of which gave information about the treatment and definitely different ways of communication. In general, they interact and communicate with some groups such as with fellow scavengers, stall owners, and the authorities (Civil Service Police Unit "*Satpol PP*"). The relation with the fellow scavengers in the category of front stage, besides sharing experience, they also help each other. The scavengers in the category of back stage consider that the other scavengers are their competitors in collecting second-handed items.

In the relation with the stall owners categorized as front stage, the subjects consider the stall owners as a place to distribute and sell the items obtained by the vagrants so it makes the stall owners as a respected and feared person. While some of the behavior indicated by the subjects when having an interaction with the stall owners as back stage in this study are indicated by some communication behaviour i.e. lying habit such as making the items wet before weighing them, mixing the items and telling that they are sick so they will not pay the debt.

One of the efforts often performed by the vagrants of front stage behavior in this research is parking the cart near the traffic light or by the roadside; this way was done as a means to trick people that they are beggars. Beggars' behavior conducted by some of the subjects in this study by sitting on the edge of the sidewalk together with their children and wives is the way to avoid the raid by Civil Service Police Unit (*Satpol PP*).

CONCLUSION

Self image of the subjects in doing communicative relation with the communication partner is done by dividing their own area: the self image for other people and the self image for themselves. The reason why the subjects work as a scavenger is caused by some factors that are all related and interconnected one another. The results, from that reasons, is categorized based on orientation or cause motive (includes: bankrupt business and friends' persuasion) and motive which includes economic and family factors.

The self conception of a person especially the subjects in this study is the social product formed through a process of internalization and organizing psychological experiences. These psychological experiences are the result of individual exploration toward the physical environment and his/her reflection with the surroundings. The selection of the vagrants' careers done by being scavengers and beggars are based on rational choice and the consideration of the subjects as well as the effectiveness of their goals to meet their daily needs. They perform impression management with a variety of partners, such as communication with fellow scavengers, the stall owners, and Civil Service Police Unit (*Satpol PP*).

Some planning strategy on self management of the subjects in this research is done by using a social setting as communication setting, i.e. by doing their working activities based on time selection and area selection.

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Examining pre-service elementary school teacher beliefs and instructional practices in mathematics class

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Abstract

The gap between theory and practice has become a critical issue in the effort of improving the learning of mathematics. Beliefs may have been one of the contributing factors to the widening of the gap between theory and practice. Therefore, examining the relationship between beliefs and practices in mathematics is crucial to gain an overview of the preparation of potential teacher candidates and the development of teacher education in the future. This study aims to examine the relationship between beliefs held by pre-service elementary school teachers and the instructional practices in mathematics class. This study employs the case study that focuses on one of the pre-service elementary school teachers who is undertaking practical field experience in the 2015/2016 academic year. The findings of this study indicate that the instructional practices do not necessarily reflect the beliefs that are held. On the other hand, beliefs about the nature of mathematics influence more dominant than the other beliefs against instructional practices.

Keywords: Teacher beliefs, pre-service elementary school teachers, instructional practices, mathematics class

Introduction

Basically, the school mathematics-based research has provided a valuable contribution to what is currently the best process for the acquisition of knowledge and skills (De Corte, 2003). The results of either quantitative or qualitative research or the combination of both leads to suggestions for the points that have to be considered in developing the teaching of mathematics in schools. However, the phenomenon of the gap between theory (including the results and recommendations of research) and practice in schools is the critical issue that needs to be raised to the "surface" (Geiger & Goos, 2006; Malone, 2000; Smith, 2000). The gap is an inconsistency between what is expected from the results of the research and decision making in practice at school.

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The teachers' belief is one of the potential factors contributing to the gap between theory and practice. The plausible reason for this is that belief becomes one of the variables that leads a person in making decisions (Pajares, 1992; Thompson, 1992). In addition, the instructional practices conducted by the teacher come from the decisions about something that is believed to be true, which comes from the knowledge that they have gained. In other words, the focus on building knowledge and beliefs is relevant to the stages of developing teachers' professionalism (e.g., Fennema, Carpenter, & Franke, 1992; Tatto et al., 2008; Vacc & Bright, 1999).

Empirically, on one hand, some researchers have found that teachers beliefs concerning the study of mathematics were consistent with their practices and behaviors in mathematics classes (e.g., Golafshani, 2005; Stipek, Givvin, Salmon, & MacGyvers, 2001; Zakaria & Maat, 2012). On the other hand, some researchers have found that there were inconsistencies between the beliefs and practices in mathematics classes (Barkatsas & Malone, 2005; Raymond, 1997). Barkatsas and Malone, through the case studies against a veteran teacher (i.e., Ann), found that Ann holds beliefs that are not always consistent with the instructional practices. The inconsistency is primarily caused by the class situation, experience, and social norms. The findings as disclosed by Raymond (1997) that in addition to the class situation, experience, and social norms, inconsistencies between the beliefs and instructional practices are influenced by internal factors (e.g., the teacher's personality) and external factors (e.g., the environment).

In Indonesia, the exploration of teachers' beliefs and practices is quite lacking, and it is the expectation of this study is able to give an overview and contribute suggestions to policymakers and subsequent researchers about how to build a strong foundation for developing the teacher education program. Some researchers agree that the golden period to build the professional teacher began when candidates were educated in College (Purnomo, 2015; Siegel & Wissehr, 2011; Volante & Fazio, 2007). Based on these reasons, this study focuses on examining the beliefs and instructional practices of pre-service teachers and the relationship of the related factors between the two variables.

Dealing with the Definition of Beliefs

Belief is an arbitrary construct designed in such a way that it is hard to give a simple definition. There are many variations of the concept of belief that is used in mathematics education research, so some researchers often formulate their own definition of beliefs that may even be contrary to others (Furinghetti & Pehkonen, 2002; Thompson, 1992). Some researchers looked at the beliefs in the cognitive domains (e.g., Thompson, 1992; Törner, 2002), other researchers put it in the effective domain (e.g., McLeod, 1992), and several others looked at the beliefs in both domains (e.g., Goldin, Epstein, Schorr, & Warner, 2011; Leder & Forgasz, 2002). Correspondingly, there are researchers who argued that the beliefs represent parts of the knowledge (e.g., Furinghetti & Pehkonen, 2002), some think that beliefs contribute to the attitude (e.g., McLeod, 1992), and the other state them as mere conceptions (e.g., Thompson, 1992).

Referring to an online dictionary (www.merriam-webster.com), beliefs may be defined as the conviction of the truth of some statement or the fact of some being or phenomenon, especially when based on the examination of evidence. Aligned with these definitions, some researchers consider that the characteristics of these beliefs refer to the degree of the person's conviction (Furinghetti & Pehkonen, 2002; Thompson, 1992). In other words, beliefs associated with the person's psychological strength may alter the degree of conviction. However, this raises further questions about what the conviction itself is. On one hand, Schoenfeld (1992) argues that beliefs can be defined as understanding and feeling of the individual which shapes the way that the individual conceptualizes and

affects their behavior. Furinghetti and Pehkonnen (2002) argue that the definition proposed by Schoenfeld is more akin to "how beliefs function".

Thompson (1992) defines beliefs as part of one's conception, namely a person's mental structure which includes knowledge, belief, understanding, preferences, and views. Thompson uses the terms beliefs and conceptions interchangeably because the differences were probably not very important to him. On the other hand, Ponte and his colleagues (Ponte, 1994; Ponte & Chapman, 2006) argued that the belief in stating that something is right or wrong, is not based around empirical evidence, and thus holds a proportional nature and does not require internal consistency. Meanwhile, a conception is a cognitive construction that can be seen as the organizing framework of the underlying concept.

Pajares (1992) distinguishes the term belief (conception) and knowledge, in which belief is based on evaluation and decision while knowledge is based on objective fact. Likewise, Griffin and Ohlsson (2001) stated that knowledge and belief refer to qualitatively different aspects of mental representation, in which knowledge refers to the representation of the proposition, and belief refer to the representation of the truth regarding the value of said proposition. Griffin and Ohlsson define knowledge as understanding or awareness of the ideas or propositions ("I understand the claim that humans evolved from monkeys"). After the proposition is known, one can accept it as true ("I believe the claim that ..."), reject it as false ("I do not believe the claim that ..."), or by reserving judgement ("I do not have an opinion about the claim that ... ").

Furinghetti and Pehkonen (2002) analyzed the relationship between belief and knowledge by dividing knowledge into two aspects: objective knowledge (i.e., knowledge accepted by the community) and subjective knowledge (i.e., knowledge created by an individual and does not have to be evaluated by others , see also Ernest, 1991, 1998). Furinghetti and Pehkonnen concluded from their analysis that beliefs refer to the individual's subjective knowledge, and when expressed as a sentence, may (or may not) be logically correct. Thus, the beliefs may not be 100% logically correct, while knowledge holds a 100% probability of being correct. Similarly, Leatham (2006) made an analogy of the relationship between beliefs and knowledge to describe that of everything we believe, there are some things that we ''just believe '' and other things that we ''more than believe '' because we ''know'' them. The things that we ''more than believe'' are reffered to as knowledge and the things that we ''just believe '' are called beliefs. Thus, beliefs and knowledge can be seen as complementary subsets of the set of things that we believe.

Abstract constructs on the definition of beliefs allow someone to give a conclusion based upon the individual perception. These constructs may occur because in order to lead the goal of research and being capable of describing each variable to focus on, the researcher should be able to give a decision and clarify the definition of the legal basis for the research focus. Therefore, this study assumes that beliefs can be in the cognitive domain if we emphasize the relationship between beliefs and knowledge. On the other hand, if the beliefs are seen from the reaction to a particular situation means we consider the beliefs associated with the affective part of individual (Furinghetti & Pehkonen, 2002). The definition of beliefs refers to the subjective knowledge of the individual (Furinghetti & Pehkonen, 2002; Op't Eynde, De Corte, & Verschaffel, 2002) based on the experiences (Raymond, 1997; Thompson, 1992) and expressed in [attitude] proposisional (Goldin, 2002; Griffin & Ohlsson, 2001; Pajares, 1992), views, and perception (Thompson, 1992) to a value of truth (Goldin, 2002; Griffin & Ohlsson, 2001). Thus, the term conception, [subjective] knowledge, belief, perception in this research is used interchangeably.

Method

Participant

This study uses case studies to explore the beliefs and instructional practices of one of the pre-service elementary school teachers, who shall be referred to as Sarijem (pseudonym) and the relationship and potential factors associated in between these two variables. Sarijem is a 7th-semester student, 21-years-old and ethnically Javanese. She is from a hometown of entrants who followed her parents working in Jakarta. Sarijem was born in East Java and has graduated from elementary school and junior high school in her native region and graduated high school in Pati, Central Java. In addition, all the schools were public schools. This study was conducted at the time when participants joined the program field experience in the academic year of 2015/2016 at one elementary school in East Jakarta. Sarijem has not had any previous teaching experience, so this study is intended to contribute to the development of teacher training courses, especially in elementary schools.

Data collection

Data were collected through a questionnaire, videotaped classroom observations and an interview. The questionnaire with open-ended questions focused on obtaining data on the beliefs about the nature of mathematics, and the beliefs about mathematics teaching and learning. Beliefs about the nature of mathematics are a viewpoint, perception or conception of someone's overall perception of mathematics as a discipline (Beswick, 2012; Ernest, 1989; Perkkilä, 2003; Thompson, 1992). Whereas, beliefs about teaching and learning is subjective knowledge or the implicit viewpoint of teachers on various types of teaching, the meaning of teaching and learning, the role of teachers and students in learning, how students learn mathematics, and class activities related to teaching mathematics (Chan, 2004; Ernest, 1989; Thompson, 1992). Videotaped classroom observations are used to obtain the behavioural and instructional practices in the classroom. In addition, beliefs, practices and related factors are explored with the semi-structured interview.

The questionnaire was given to Sarijem before she performed a series of classroom teachings. The questionnaire contains open-ended questions in the following order (adapted from Adam, 2012) .

1. How do you explain what mathematics is to someone who has never heard of mathematics before?

2. What do you think mathematicians do when they work with mathematics?

3. In your opinion, what is the best way for children to learn mathematics?

4. What methods do you have that can have an effect on the way students learn mathematics?

5. In maths class, what do you think about the role of (a) teachers and (b) students?

6. In your opinion, what is the most effective way of teaching mathematics?

The six 35-minute teaching sessions were videotaped in order to obtain data on instructional practices in the classroom. Sarijem taught the fourth grade with materials related to the greatest common factors and least common multiples.

After the series of teaching activities were completed, interviews were conducted to elaborate Sarijem's beliefs that she had stated in her answers to the questionnaire. The interview was carried out using similar questions to those asked on the questionnaire and was recorded using the audio-recording application on a hand phone. Furthermore, the

interview was also conducted to elaborate the instructional practices conducted by Sarijem and the factors associated with beliefs and practices. Some questions in addition to those contained in the questionnaire are shown as follows.

1. How do you teach mathematics?
2. Why did you introduce the mathematical ideas in this manner?
3. How did you help students understand the new ideas?
4. What encouraged you to teach in this manner?
5. What limits you in being able to teach mathematics in the way you want/plan?

Data analysis

The questionnaire responses were analyzed with an interesting pattern and elaborated through the interview. Related audio recordings and the transcribed interview was analyzed to describe the beliefs held by Sarijem. The pattern of responses related to the questionnaire and the interview are categorized into traditional beliefs (absolutist), primarily traditional, primarily constructivist, and constructivist (fallibilist) for the dimensions on the nature of mathematics and the teaching and learning of mathematics.

The recorded video was played and viewed together with the participant along with the interview to explore the teaching practices and limitations that the participant faced throughout the teaching sessions. This was done to confirm the answers to the questions stated in the questionnaire and the interview beforehand. The video footage and interview has been transcribed, then read and verified again by the participant to ensure the accuracy and thoroughness.

Results and Discussion

This section discusses Sarijem's beliefs by splitting them into two separate parts, i.e. beliefs about the nature of mathematics and beliefs about teaching and learning mathematics. The analysis of the interconnectedness of beliefs and practices as well as potential factors that influence them was addressed afterwards.

Sarijem's beliefs about the nature of mathematics

Based on the pattern of responses to the "open-ended questions" on the questionnaire and the interview session, beliefs about the nature of mathematics held by Sarijem leads to the combination of traditional and constructivist view, with primarily traditional mathematics. Sarijem states that mathematics is an exact science that is used by humans as a means of counting everyday problems. When asked more about mathematics, Sarijem stated that mathematics is a science that is applicable and relevant to a person's experiences and everyday problems. Ernest (1991) states that the constructivist view of looking at mathematics as part of a blend with the human culture, so that it cannot be separated with the knowledge of physical and other sciences. In other words, mathematics comes from and for social purposes.

> The researcher: How do you explain what mathematics is like to someone who has never heard of mathematics before?
>
> Sarijem: ... Mathematics is a science that is used by humans to help calculate
>
> ...include the symbols and rules to do the calculations....
>
> The researcher: Besides that, what else do you think about maths?
>
> Sarijem: Mathematics is also used in other studies and is relevant to the problems of everyday life.

The researcher: Earlier, you said that mathematics includes a collection of symbols and rules. According to you, who makes the rules? Is it the mathematicians or does everyone have a chance to make or add to them?

Sarijem: Mathematicians, sir, because mathematicians have a thought process that is coherent and logical ... if we're not coherent and logical thinking.

The researcher: Ok. Do you think that the mathematical rules that already exist could be wrong?

Sarijem: I think not, sir, because the rules have been established through a series of experiments and published afterwards.

Sarijem stated that the rules of mathematics are accepted to be true. The mathematical rules and facts can't be doubted and hold an undeniable truth. Furthermore, Sarijem also stated that the role of mathematicians is crucial in the development of mathematics. The mathematical objects are discovered by mathematicians through a series of experiments and published after perfection. Sarijem's views about maths are in line with the views held by an absolutist. Absolutists see mathematics as absolute truth, accepted by everyone, and does not rely on the human knowledge and context (Ernest, 1991; Hersh, 1997). The views absolutists can be associated with the platonic, formalist, and logicist views stating that mathematics is as absolute as a divine gift, a formal language without error or contradiction, does not depend on human knowledge, waiting to be discovered and has existed before the birth of mankind, a set of rules and procedures that are rigid and picture mathematics as essential calculations (Ernest, 1991; Hersh, 1997; Sriraman, 2004; White-Fredette, 2010). In other words, mathematical objects are taken for granted to be applied by the user.

Sarijem's beliefs about teaching and learning mathematics

Typically, Sarijem adopts beliefs about mathematics teaching and learning that is primarily constructivist-oriented. Sarijem stated that the best way to learn mathematics is by connecting mathematics with daily life. The following is Sarijem's statement about the best way to learn mathematics.

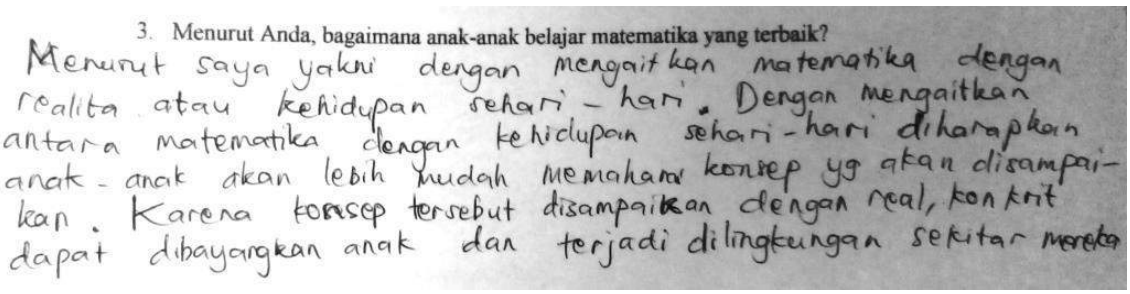
3. Menurut Anda, bagaimana anak-anak belajar matematika yang terbaik?
Menurut saya yakni dengan mengaitkan matematika dengan realita atau kehidupan sehari-hari. Dengan mengaitkan antara matematika dengan kehidupan sehari-hari diharapkan anak-anak akan lebih mudah memahami konsep yg akan disampaikan. Karena konsep tersebut disampaikan dengan real, konkrit dapat dibayangkan anak dan terjadi dilingkungan sekitar mereka

Figure 1. *Sarijem's statement about the best way to learn mathematics*

Translate: 3. In your opinion, how can children best learn mathematics?

Sarijem's Answer: In my opinion, it is best to associate mathematics with reality or everyday life. By linking mathematics to daily life children will easily be able to understand the concepts that are being delivered. Because the concept is presented with something that can be imagined by children and occurs in the environment around them.

In the interview and discussion sessions, Sarijem stated that "...by associating mathematics with daily life experiences, students can easily find and grasp the concept if they can imagine it." Moreover, Sarijem also stated that "... it is difficult for the students, especially in elementary school, if mathematics is not associated with anything they can imagine." Sarijem's beliefs about the best way of teaching and learning mathematics are consistent with her beliefs that mathematics cannot be separated from the human context and everyday life.

In the questionnaire, Sarijem stated that the teacher's role in learning is as a facilitator in guiding students to discover new knowledge. Meanwhile, the student's role is as a person seeking information or knowledge. Sarijem's statement was in line with the constructivist view which proposes that the conception and understanding of learners come from the construction of meaning where learners are involved in the process of building the individual interpretation of their experiences (Applefield, Huber, & Moallem, 2000; Kundi & Nawaz, 2010; Ari, Tunçer, & Demir, 2016). The following is Sarijem's statement about the role of teachers and students in mathematics class.

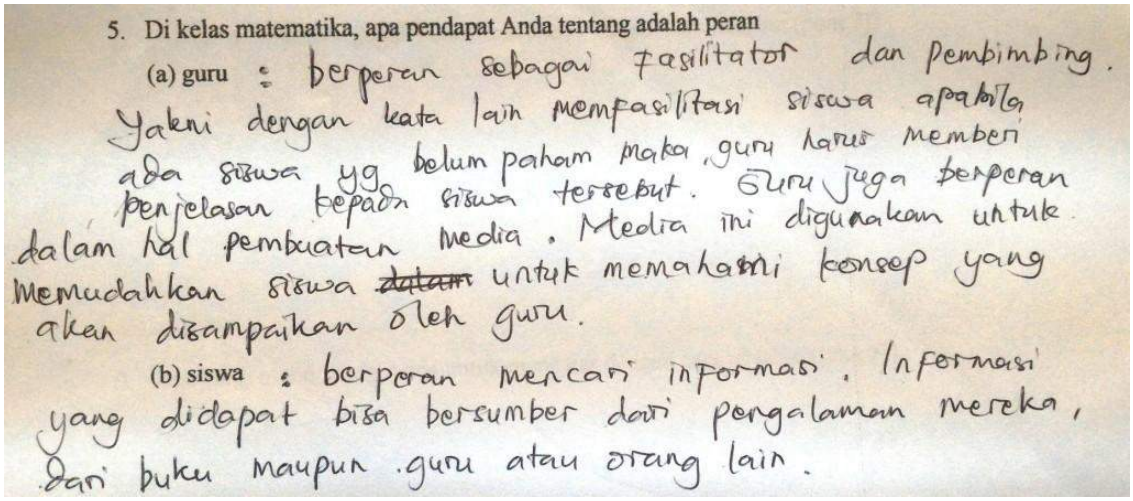
5. Di kelas matematika, apa pendapat Anda tentang adalah peran
(a) guru : berperan sebagai fasilitator dan pembimbing. Yakni dengan kata lain memfasilitasi siswa apabila ada siswa yg belum paham maka guru harus memberi penjelasan kepada siswa tersebut. Guru juga berperan dalam hal pembuatan media. Media ini digunakan untuk memudahkan siswa ~~dalam~~ untuk memahami konsep yang akan disampaikan oleh guru.
(b) siswa : berperan mencari informasi. Informasi yang didapat bisa bersumber dari pengalaman mereka, dari buku maupun guru atau orang lain.

Figure 2. *Sarijem's statement about the role of teachers and students*

During the discussion sessions and interviews, the researchers identified what is believed by Sarijem about the role of teachers and students is very close with her knowledge of the theory and learning perspective. However, Sarijem's incomplete understanding about the meaning of "teacher as a facilitator" and "students as active constructors" causes what is known as a fallacy of beliefs. When asked about how to facilitate student learning, Sarijem expressed a way to help students who are having difficulty and assisted them in finding solutions to problems, while actively connecting with the activity of thinking.

> The researcher: At the time of facilitating the students, they were expected to participate actively in the learning process. What are the conditions or situations in which the students can be described as active?
>
> Sarijem: When teachers ask open-ended questions or probing questions so that students can think of the problems encountered.
>
> The researcher: So, do you think active in this respect is when students think about the problems through the questions that you asked?
>
> Sarijem: Yes sir, (with accompanying assertion) ... when students are thinking, that means they're being active, sir.

I found that during the interview session, Sarijem's beliefs about teaching have been including her beliefs about learning explicitly. Sarijem adopts beliefs about learning in the perspective of a teacher, so when thinking about the best way to learn mathematics, it is always expressed with how to make students learn the best (a related approach to teaching the teacher to make students learn the best). Thus, the beliefs held by Sarijem about learning mathematics can be said to be a subset of beliefs about teaching mathematics. The plausible reasons for this is because the beliefs about teaching mathematics are subjective or the implicit viewpoint of teachers on various types of teaching, the meaning of teaching and learning, the role of teachers and students in learning, how students learn mathematics and class activities related to teaching mathematics (Chan, 2004; Ernest, 1989; Thompson, 1992). In other words, beliefs about teaching mathematics include beliefs about learning mathematics.

Reflecting on Instructional Practices from Sarijem's Beliefs and some factors that limit it

Under certain circumstances, the instructional practices conducted by Sarijem reflect on what she believes. Sarijem believes that mathematics is a science that is very relevant to the context, the experience and the daily life of human beings, in line with the beliefs about teaching and learning expressed in a way of how to relate mathematics to the context, experience and the student's daily life. This reflects the beliefs held by Sarijem by always trying to initiate the material that she attributed to the context and experience of students. Sarijem also tried to mediate between mathematics and the "context" with the use of props and media.

Sarijem believes that her instructional practices are constructivist orientated because she considers that it integrates the "context" of students into mathematics learning in the classroom. She also felt that the media and props are indicators that she has applied constructivist-orientated practices. These practices are the reflection her beliefs that mathematics is relevant to the context of the students. However, referring to the opinion of Lakatos (in Ernest, 1991, 1998) and Hersh (1997), mathematics is a human activity, in which mathematical objects are in the nature of human knowledge and are a product of human findings. "Students are active" based on this view can be defined as the process of reinvention. Students build their own knowledge of mathematics as facilitated by their teachers. This is in contrast to what happens in Sarijem's class, the use of media and props are more dominated by teachers as a model. Most students act as spectators of what is practiced by the teacher. This is inconsistent with what has been stated that the teacher acts as a facilitator while students are active constructors of knowledge. The instructional practices are more likely to reflect the beliefs held by Sarijem that mathematical objects can only be discovered by mathematicians, the only people capable of specifically discovering and formalizing forms of mathematics. Mathematics are accepted as true, so that students are asked to be "users", which record what is seen and heard and then just apply it. I identified that Sarijem's knowledge of the philosophy of mathematics and learning theories less profoundly form the fallacy beliefs whose practices refer to what she believed was true.

When explaining the solutions to solving problems related the greatest common factor (GCF) and least common multiple (LCM), Sarijem uses factor trees for prime factorization. Sarijem explained that the rules of using the factor trees start by dividing the number interested with the smallest prime number. In the interview, Sarijem explains that such a rule is easily memorized, making it likely students will also find it easy to learn. Sarijem states that the rule is fixed, so in order to solve mathematical problems, users must be use rules that already exist. The following is an excerpt of the interview when discussing the process of explaining the solution GCF (24, 32)

The researcher: Why did you divide by two, why not four or eight?

Sarijem: Actually, it's not always two, sir. According to my memory, in order to find the GCF and LCM by prime factorization, we should start from the smallest prime number first, sir. So, when it cannot be divided by 2, then it can be continued by dividing by 3 and so on, instead of four or eight, because they are not prime numbers. Textbooks, too, start from the smallest prime number anyway, sir.

The researcher: So, should we not be numbers other than prime numbers? Why is that?

Sarijem: No sir, because that is the rule, sir. During my own school experience, rules were like that.

The researcher: Ok. Now, I would like to ask why we are looking for the GCF and LCM by finding prime factors? Why not factor of other numbers?

Sarijem: I do not know sir, that's the rule of the finding the GCF and LCM, sir (laughing).

Sarijem's practices, which emphasized the rigid rules and procedures when explaining the prime factorization, are consistent with her beliefs that mathematics is an accumulation of facts, rules and procedures and then using said knowledge to solve the problem that is accepted as true. What she believes contradicts the constructivist view, which states that mathematics is not discovered, but constructed by humans so that the rules and procedures of mathematics can be created by anyone. Thus, mathematical problems can be solved by various methods or approaches that can be undertaken by students. Students can be guided to find a canonical sequence of 24 and 32 in their own way. Some examples of how using mental strategies can be illustrated as follows (Purnomo, 2014).

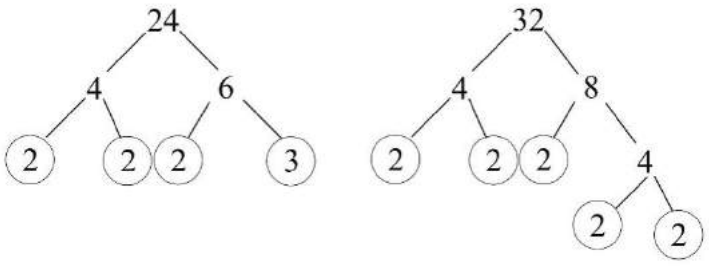

Figure 3. *The Mental Strategies factorization*

I identified that in addition to the previous school experiences, the lack of mathematical knowledge for teaching also became contributing factors which lead to practices that affect Sarijem's approach towards instrumental teaching. Sarijem did not yet realize that looking for LCM and GCF can be done using prime factorization epistemologically. I use the term "epistemological content knowledge" as one of the forms "mathematical knowledge for teaching" in this case. Epistemological content knowledge requires teachers to reflect epistemologically on mathematical structure as the foundation in establishing and communicating mathematical arguments. For example, the teacher must interpret and able to connect between the prime factorization and the fundamental theorem of arithmetic.

I also identified that the practice is carried out by Sarijem were more performance-orientated, which is focused on the students' ability to work on the problems quickly and correctly. The practice also still focused on the textbook as the main reference to teaching and did not dare to abandon the habit of using the rules contained in the book. Sarijem

admitted that while in school, she was also taught to do so by her teacher, so it feels odd to not follow the rules out of habit. This instrumental teaching resulted in students learning leads to a superficial learning dominated by memorizing facts and rules. Consequently, students often experience errors, do not interpret what was done, and lack the sensitivity and ability of a problem solver (Purnomo, Kowiyah, Alyani, & Assiti, 2014; Yang & Wu, 2010).

Focusing on the interaction between students and teachers, the interaction was dominated by one-on-one dialogue between Sarijem and her students. The dialogue was conducted by Sarijem using probing questions. High frequencies shown that Sarijem would come near to students to seek information through a series of questions that are guiding towards the discussion. Sarijem believed that was one way of making the students actively engage in the learning process. Sarijem uses questions as a way to assess the experience and knowledge of her students. In other words, the richer the feedback obtained from the students, teachers will increasingly understand the weakness and can continue to improve it. This strategy as suggested by some researchers uses effective questions, and is one of the strategies for integrating assessment into learning (Black, Harrison, Lee, Marshall, & Wiliam, 2003, 2004; Lee, 2006; Purnomo, 2015; Sumantri & Satriani, 2016). However, the peers involvement to provide feedback get less opportunity. The opportunity was not also provided in most of Sarijem's practices in the classroom, that the interaction between students and peers received less emphasis. This fact is not consistent with what she declared that students who engage in collaborative learning always benefit in their learning.

In interviews and discussion sessions, Sarijem stated that the opportunity to do collaborative learning is difficult because of time pressure and the material must be prepared by the mid-term deadline. Furthermore, Sarijem also realized that the practice that was planned was constrained by the learning environment, especially the behavior of students in the classroom. Sarijem realized that she could not organize the class because of the number of students, which exceeded the quota. For these reasons also, Sarijem had to limit the process of discussion between the teacher and the student.

Conclusions

This research examines the beliefs and practices of pre-service elementary school teacher early in her experience teaching mathematics. The findings of this study indicate that (1) beliefs about the nature of mathematics held by Sarijem are more traditional than her beliefs about teaching and learning mathematics, (2) the practices that are done by Sarijem are primarily more traditional than constructivist, and (3) the instructional practices do not always reflect on the beliefs that Sarijem holds. The complex relationship of related beliefs and practices were also encountered by some previous researchers (e.g., Barkatsas & Malone, 2005; Raymond, 1997; Shield, 1999). Some identified factors restricting the practice of Sarijem in mathematics class so that it is not always consistent with her beliefs, including the previous school experience, social norms, mathematical knowledge for teaching, the attitude that dares not to act out of habit, time constraints, high-stakes testing, curriculum, student behavior and the learning environment. Further, inconsistencies between beliefs held by Sarijem were influenced by the weak knowledge of the philosophy of mathematics and the learning theory.

The findings of this study indicate the important role of the philosophy of mathematics, as proven instructional practices done by Sarijem more reflected her beliefs about the nature of mathematics. This can also be found in previous studies (e.g., Perkkilä, 2003), which reveals that beliefs about the nature of mathematics contribute more strongly than other beliefs. Chassapis (2007) proposed some arguments about the philosophy of mathematics

that hold a key position in the professional knowledge of mathematics teachers. The first argument confirmed the direct relationship between the philosophy of mathematics and the basic features of mathematics education. The second argument is that the ideas, views, conceptions, or beliefs about mathematics teachers, teaching, and learning, reflected or related to the philosophy of mathematics implicitly. The third argument stated the undoubted assumption that the philosophy of mathematics is directly related to understanding the contents in mathematics as knowledge to be taught. It can be used as input to the curriculum of the Elementary School Teacher Education program to integrate the philosophy of mathematics into the philosophies that are commonly used in the current curriculum.

Continuous reform towards higher education curriculum in Indonesia generally and Education Studies Program for elementary school teachers in particular have become a necessity. It is important that in addition to the knowledge of content, mathematical content knowledge for teaching also needs to be stressed. It is none other than the Education Studies Program that is designed for the curriculum of elementary school teachers, who place more emphasis on aspects of mathematical content knowledge and is more oriented to high-level cognitive abilities, but the integration of mathematical knowledge for teaching is weak.

The importance of practical experience for pre-service teachers also needs to be addressed by policy makers at the higher education level, by integrating field experience on an ongoing basis and not just at the end of their coursework. It is useful to provide an opportunity for pre-service teachers related to the self-reflection of instructional practices in the classroom as the way to develop knowledge and beliefs or maybe refine them in the future. This can be done in several ways, such as (1) involving pre-service teachers in self-study to either himself or the teacher's example as the subject, (2) making the program provide an opportunity for pre-service teacher ' observations in schools, and (3) involving pre-service teachers in research activities on an ongoing basis.

• • •

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Assessing Number Sense Performance of Indonesian Elementary School Students

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Abstract

The intention of the present study is to know how students' performance on number sense based on the components of number sense and also the sub-components in it. The participants of the study are 80 six graders (12-13 year-old) from three different schools that represent the city, rural, and small town areas. The data were collected using the test. The data analysis showed that the elementary school students' performance on number sense was still weak on the component of understanding the meaning and concept of numbers. This could be seen in 23.53% respondent. The highest average was 49.75% in understanding the meaning and effect of operation. Nevertheless, the students' responses indicated that most of those were more dominated by the written algorithms in solving problems. This was also happened on the component of applying knowledge and number sense and operation in computational situation. The students found some difficulties in understanding the meaning and concept of numbers, especially on the domain of fraction and decimal. There were some obstacles the students had, such as misconception about the density of fraction and decimals, about the concept of the part of fraction, and some errors when doing the computation because they paid more attention to the rules and algorithms they understood.

Keywords: number sense, numbers, written algorithm, elementary school students, Indonesia

1. Introduction

1.1 Background

Numbers is one of the most fundamental mathematics concepts in the elementary school that aims in (1) solving daily-life problems, (2) being the base of all mathematics curriculum, and (3) developing the sense about the numbers itself (National Research Council [NRC], 2001; Anghileri, 2006). Moreover, NRC (2001) stated that the concept of numbers is useful as the base of all mathematics curriculum and also useful in understanding the concept of measuring, geometry, algebra, and data analysis. By learning the concept of numbers, the students are expected to be able to appreciate the beauty and the importance of mathematics.

Some studies that have been done in Indonesia showed that students' understanding of numbers is still weak especially in doing the computation or counting. This was happened because students' ability in computation was more dominated by the written algorithm (Herman, 2001; Purnomo, 2013). With written algorithm, students had to find the solution of $38 + 25$, $43 - 14$, 28×8, or $64 \div 16$. Many times, students did some errors in doing the algorithm when they tried to solve the above problems. In Sumarto, van Galen, Zulkardi, and Darmawijoyo (2014), Zulkardi stated that there are the collection of rules and algorithms in most of the school textbooks in Indonesia. This indicated that students were many times faced with the mechanistic instructions of stiff procedures of algorithm.

Students' understanding about numbers is not only about being able to do the counting procedure based on the written algorithm, but also about students' sense of numbers itself. According to McIntosh, B. Reys, and R. Reys (1992), the numbers sense refers to someone's common understanding of numbers and the operation between them and also someone's ability and tendency to use the understanding in making flexible mathematics decision

and to develop useful strategies to master it. Moreover, Gersten and Chard (1999) described number sense with a new construction that refers to students' fluidity and flexibility with numbers, their sense about the meaning of numbers and their ability in doing mental mathematics and seeing the world and making comparison. In other words, number sense is one's ability in understanding the concept and procedures of numbers and its operation, and in using it to make mathematics decision with various effective, efficient, and flexible strategies.

The number sense teaching and learning is very important to be done in the elementary school because of some reasons. Yang and Wu (2010) had synthesized that there were at least four reasons behind the importance of number sense. First, number sense is a way of thinking that represents flexibility, inventiveness, efficiency, and reasonableness. For instance, when students were asked to find the solution for $24 \times 65 \div (6 \times 13)$, they usually used the written algorithm such as $24 \times 65 = 1560$, $6 \times 13 = 78$, and $1560 \div 78 = 20$. For many students, these strategies were somewhat hard to be followed. More efficient and effective strategies that could be used by the students were knowing that $24 \div 6 = 4$, $65 \div 13 = 5$, and then $4 \times 5 = 20$. Second, number sense is a holistic concept of quantity, numbers, operation, and the relationship among them, that can be applied efficiently and flexibly in daily-life situation. Third, some adults is depending on number sense to think mathematically and to represent numbers. Forth, the over-emphasized on the written counting procedure is not only impeding students' mathematics thinking and understanding, but also obstructing their number sense ability. Beside those reasons mentioned above, the number sense is also facilitating someone to solve problems, to give reason to something, and to discuss mathematical idea (Shumway, 2011).

The understanding of number sense is important because it has a unique and meaningful contribution to the mathematics learning. The power of number sense's prediction was also getting stronger from time to time (Jordan, Glutting, & Ramineni, 2010). Moreover, in seeing the early picture of developing number sense ability is useful to identify the students with difficulty in mathematics later on (Jordan, Kaplan, Locuniak, & Ramineni, 2007). The teachers have to be able to see the importance of understanding the number sense for their elementary school students.

Assessing number sense is an important and challenging strategy to the curriculum designers and mathematics researchers (Yang, Li, & Lin, 2008). It is also important to the teacher as a tool that can be used in the classroom to see students' understanding of concepts and procedures of numbers and the operation. Number sense has been an international study topic in order to develop mathematics education, even until now. Ironically, number sense has not been understood clearly by the school-teachers yet (Faulkner, 2009).

McIntosh et al. (1992) suggest that there are at least three components of number sense that can be assessed from students' number sense ability, such as (1) knowledge of and facility with number, (2) knowledge of and facility with operations, and (3) applying knowledge of and facility with numbers and operations to computational settings. These three components have been used as a basis of some international studies to access number sense qualitatively, quantitatively, and even the combination between those two (see Reys et al., 1999; Tsao, 2004; Singh, 2009; Yang, R. Reys, & B. Reys, 2009; Yang & Wu, 2010; Tsao & Lin, 2011; Courtney-Clarke, 2012). The three components of number sense aforementioned will be described clearly on Table 1 on the next page.

1.2 Objectives of the Study

Since the understanding of number sense is important for the next step of mathematics learning, by assessing students' performance on number sense, the teachers can reflect their instruction as the first step to develop number sense, especially for elementary students. The intention of the present study is to know how students' performance on number sense based on the components of number sense and also the sub-components in it.

2. Method

2.1 The Participants

The participants of the study are 80 six graders (12-13 year-old) from three different schools that that have been randomly chosen to represent the city, rural, and small town areas. These grades were chosen because the researchers wanted to see students' number sense performance after their learning process in their first to sixth year of elementary school. There were 46 students from the city school, 21 students from the rural school, and 13 students from the small town school.

2.2 Data Collection

2.2.1 Instruments

There was a test conducted to collect the data that would be used in identifying students' performance of number sense. In order to validate the test instruments, beside consulting them to the experts, the researcher also adapted

the items of the test to every components of number sense from McIntosh et al. (1992) and adopted some items from the study of McIntosh, B. Reys, R. Reys, Bana, and Farrell as cited in Singh (2009). The researcher kept the original contents of some adopted questions, but those questions were then re-designed by translating them into Indonesian language, the difficulty level of the questions was adapted into the elementary school curriculum in Indonesia, and the numbers of questions were reduced into 30 items. The reliability of the test was tested using Alpha Cronbach at the coefficient of 0.73 (more than 0.7) so that it could be concluded that the test was reliable (Budiyono, 2003).

Table 1. The number sense components with each indicator

The number sense components	Indicators/ Sub-components	Test items
Knowledge of and facility with numbers	Sense of the order of place value on the number line	2, 10, 11, 30
	Sense of various representation of numbers	7, 14, 16
	Sense of the absolute and relative value of numbers	3, 9, 29
	System of benchmarks	6, 27
Knowledge of and facility with operations	Understanding the effect of operation	21, 22, 23
	Understanding the nature of operation in numbers	18, 24, 25
	Understanding relation between operation	4, 5, 13, 20
Knowledge of and facility with numbers and operations to computational settings	Understanding the relation between the contexts of the problems and the appropriate computation	12, 26, 28
	Awareness of various strategies	15, 19
	Tendency to use a representation efficiently	1, 8
	Tendency to review the data and the reasonable results	17

2.2.2 Procedure

The test of number sense was given to all of the participants that voluntarily agreed to participate in the present study. Before conducting the test, the rules in doing the test were read by the researcher, which were: (1) the participants were not allowed to start doing the test until the command was given by the researcher; (2) they were given 1 minute and 10 seconds to solve every questions; and (3) they were not allowed to move on to the next question and/or move back to the previous one until the time was over. The time was controlled by the researcher when the participants were doing the test so that they could use their intuition rather than the written algorithm, and they could predict the reasonable result.

2.3 The Data Analysis

The scoring procedure to every test items except for items number 2, 10, 11, 27, and 30 was giving 1 to every correct answer and 0 to the incorrect answer. The score 2 was given for the items number 2 and 30 for the correct answer and reason, 1 for correct answer but incorrect reason, and 0 for incorrect answer with no attention to the reason whether it was correct or incorrect. For the items number 10, 11, and 27, the score given was 2 for all answers were correct, 1 for only one answer was correct and the other was incorrect, and 0 for all answers were incorrect. The total of the scores that was possible were 35. The data was then analyzed quantitatively to see the mean, median, and the standard deviation for every component of number sense. The percentage of the respondent's correct answers was used to see their performance in every item in the test of number sense.

3. Results

The analysis of number sense performance was categorized base on every component of number sense by paying attention to the mean, median, and the standard deviation. The analysis was then continued by seeing the number of respondents giving the correct answer (in percent) on every item in each sub-component of number sense. The description of students' performance base on the component of number sense and the performance analysis for every item on each of the component of number sense was given below.

Table 2. Performance in every component of number sense

N = 80	Knowledge of and facility with numbers	Knowledge of and facility with operations	Knowledge of and facility with numbers and operations to computational settings
The number of questions	12	10	8
Mean	26,35%	49,75%	42,19%
Median	18,5	38,5	29
Standard deviation	19,48	16,55	25,5

On the Table 2 above, it can be seen that the students' performance was low on the component of knowledge of and facility with numbers. We can conclude it by seeing the average the students get was 26.35% out of all the respondents. The highest average, 49.75%, was in the component of knowledge of and facility with operations. Overall, the result showed that students' performance in computation was better than their understanding about the concept of numbers.

3.1 Knowledge of and Facility with Numbers

On this first component of number sense, there were 26.35% respondents gave the correct answer, which was also the lowest average among the other two components. There were 12 questions about the component of understanding the knowledge of and facility with numbers, consists of the sub-component sense of the order of numbers, sense of various representation of numbers, sense of the absolute and relative value of numbers, and using the standard criterion of measuring. Below were the data of respondents' correct answer on every item for the first component.

Table 3. Percentages of the correct answer the respondents given on every item for the first component

Sub-component	The item number	The number of respondents giving the correct answer	Percentage
Sense of the order of numbers	2	0	0%
	10	3	3,75%
	11	8	10%
	30	0	0%
Sense of various representation of numbers	7	37	46,25%
	14	1	1,25%
	16	28	35%
Sense of the absolute and relative value of numbers	3	44	55%
	9	49	61,25%
	29	10	12,5%
System of benchmarks	6	27	33,75%
	27	46	57,5%

There were two items of this component that more than 50% respondents gave their correct answers, those were the item number 9 and 27. Each of those represented the sub-component of the sense of the absolute and relative value of numbers, and the system of benchmark.

The lowest results found in the sub-component of sense of the order of numbers, in which there were not more than 10% respondents gave their correct answers. This sub-component consisted of four questions related to the density of fraction, decimals, locating the number on the number line, and putting the number on the number line. The items number 2 and 30, respectively represented the nature of the density of fraction and decimals, were

hard enough to be solved by most of the participants. The following are students' work with the misconception on the nature of the density of decimal (see Figure 1) and fraction (see Figure 2).

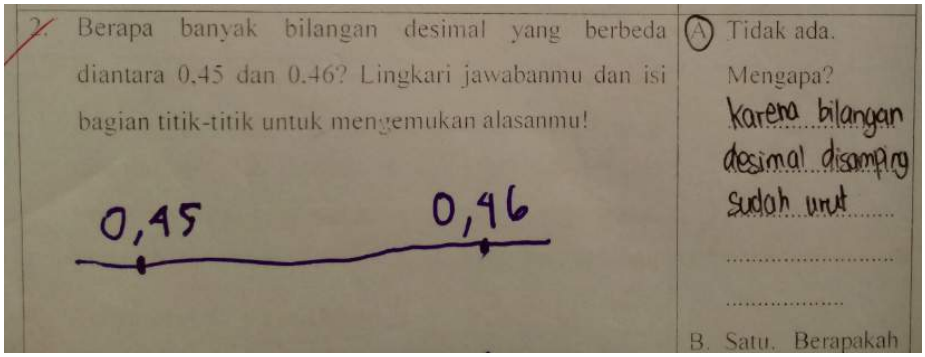

Figure 1. Avira's answer

Translation:

2. How many different decimals numbers between 0.45 and 0.46? Circle your answer and then fill in the blank to write the reason!

A. None. Why? _____

B. One. What is it? _____

C. A few. Give Two Examples. _____ and _____

D. Many. Give Three Examples. _____and _____and _____

Avira's answer: A. None, because those two decimals was already ordered correctly.

Avira used her understanding about the order of the natural numbers and saw that after 45 would always be 46. It was incorrect because the decimal order was different with the order of natural numbers. The numbers between 0.45 and 0.46 could be seen as the numbers between 0.450 and 0.460, or between 0.4500 and 0.4600, etc.

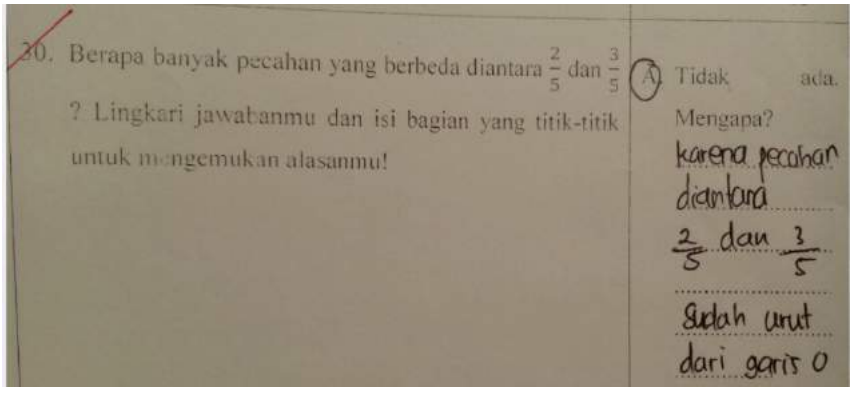

Figure 2. Gretha's answer

30. How many different fractions among 2/5 and 3/5? Circle the best answers and write your reason in the blank area!

Gretha's Answer: No one, because later 2/5 is 3/5.

This was quite the same with what happened on the item number 2, Gretha saw that after 2, there was exactly number 3 so that she concluded that there was no fraction between them. To see the fractions between 2/5 and 3/5, we can see the the proportion between those two, such as 4/10 and 6/10; or 6/15 and 9/15; and so on.

Both two answers students gave aforementioned represented almost 95% misconception the students had. They

thought that there was no different numbers between 0.45 and 0.46 (or 2/5 and 3/5 in the case of fractions) because those numbers were already ordered correctly and written adjacently. The misconception that commonly happened in the students' mind was that they used their understanding about the natural numbers in the number line to solve the fraction (decimal) order and density problems. The nature of the density of fraction required the understanding that there were infinite fractions between two fractions with different proportion. The nature of density was also applied on the decimal numbers because decimals could be seen as a representation of fraction on the base-ten notation.

Still about the first component, misconception also occurred when the students were asked to represent the fraction visually on the item number 14 below.

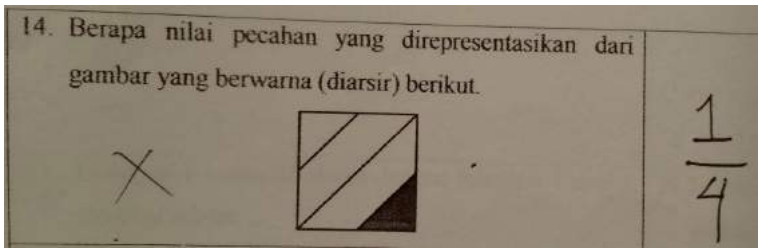

Figure 3. Sofyan's answer

Translate:

14. What's fraction that represented following figures.

Sofyan's answer: 1/4.

Seventy-eight participants wrote 1/4 for the answer of this item, 1 participant answered 1/3, and only 1 participant answered 1/8. Most of the students saw the concept of fraction by counting the shaded part as the numerator and the whole part as the denominator without considering if the size of each part was equal. The correct concept of fraction needs us to find out the fair part of the whole, by considering both the numerator and denominator.

3.2 Understanding the Meaning and Effect of the Operation of Numbers

This component had the highest average compared with the other two components, 49.75%. There were 10 items in this component that represented three sub-components in it. Those sub-components consisted of understanding of the effect of operation, natures of numbers operation, and the relation between numbers operation. The percentage of respondents that gave the correct answer on every item was shown below.

Table 4. Percentage of respondents that gave the correct answer on every item of the second component

Sub-component	The item number	Number of respondents answered correctly	Percentage
Understanding the effect of the operation	21	20	25%
	22	34	42,5%
	23	48	60%
Understanding the nature of numbers	18	25	31,25%
	24	23	28,75%
	25	25	31,25%
Understanding the relation between numbers operation	4	57	71,25%
	5	43	53,75%
	13	63	78,75%
	20	60	75%

Based on the Table 4 above, all questions on the sub-component understanding the relation between numbers operation had more than 50% respondents answered correctly. The items number 13 was the question that had most respondents answered correctly. However, most of students' work consisted of their hand-writting on the answer sheet. This indicated that the students still paid more attention to the written algorithm, by counting each operation, and then compared the results of each counting. Figure 4 below is showing the question and an example of students' answer.

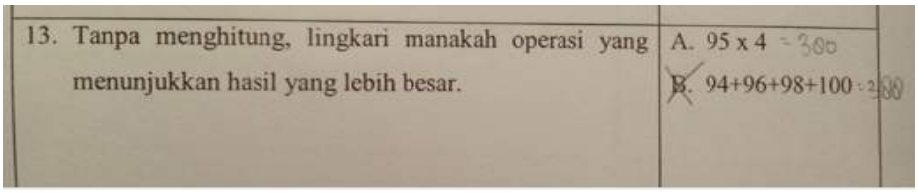

Figure 4. Hasanah's answer

Translation:

Without calculation, circle the expression which represents the larger amount.

A. 95 × 4

B. 94 + 94 + 98 + 100

Hasanah's answer: B. 94 + 94 + 98 + 100

The above question could be efficiently and effectively answered by looking at the relation between those two operations. Multiplication can be seen as repeated addition, so that 95 × 4 was another way to express 4 × 95 which meant the addition of four 95s. From the expression of repeated addition, it could be seen than 94 + 96 + 98 + 100 had a bigger result.

The item number 21 had the lowest percentage of students who answered correctly, that was 25%. The item asked students to use their understanding about how to multiply one-digit number with another one-digit number. Most of the students' answers showed that those multiplications would result also a one-digit number. The mistake that could be happened was that the students initially multiplied the numbers with one so that the multiplication of one-digit numbers would result one-digit numbers also. They concluded the solution of their initial idea could be generalized to all problems.

There were not more than 32% of respondent gave the correct answer to the second sub-component. This was the lowest achievement among the other sub-components in the second component. On the other side, the result didn't show that the students used their understanding about the nature of operation. It could be seen that instead of using the more effective and efficient strategy by considering the nature of operation, the students mostly used the strict computation rules. This finding proved that most of the students prefer to use their understanding in using the written algorithm procedure to their intuitive understanding about numbers, operation, and the relation between them.

3.3 Knowledge of and Facility with Numbers and Operations to Computational Settings

There were 42.19% students gave the correct answers to this component with 8 questions represented four sub-components. Below is the amount of respondents answered correctly every items on this third component.

Table 5. Percentage of the amount of respondents answered correctly every item on the third component

Sub-component	The item number	Amount of respondent answered correctly	Percentage
Understanding the relation between the context of the problems and the appropriate computation	12	30	37,5%
	26	18	22,5%
	28	62	77,5%
The awareness of various strategies	15	3	3,75%
	19	11	13,75%
The tendency to use a representation and/or an efficient strategy	1	28	25%
	8	78	97,5%
	28	62	77,5%
The tendency to review the data and reasonable results	17	40	50%

On this third component, the lowest result was in the sub-component of awareness of various strategies. It could be seen that there were less than 14% respondents gave correct answer to each questions in this sub-component. Below was an example of students' answer when they were asked to use various strategies in answering the daily-life problems related to the percentage.

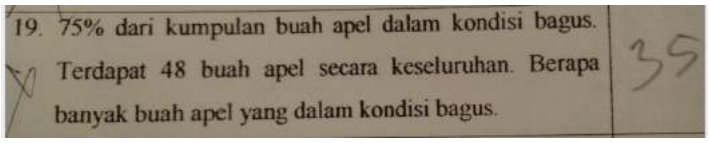

Figure 4. Safira's answer

Translation:

75% of a set of apples has a good condition. There are 48 apples in the set. How many apples that have the good condition?

Safira's answer: 35

There were so many strategies that could be used, one of those was to think that 48 apples could be represented as 100%. We could think that in order to find out 75% of it, we could initially find out 25% of it. Dividing 100 by 4 could do this, so that 25% of 48 apples were 12 apples. By understanding this, 75% of apples were the same with 36 apples.

The highest percentage of respondents who answered correctly was in the indicator of the tendency to use a representation and/or an efficient strategy on the item number 8. The students were asked to do the subitizing by seeing the pattern they already knew.

Overall, students' performance at the third component was higher than the other two. Nevertheless, there were some indications that most of the students dominantly used the written algorithm. This could be seen from the students' written work when using the rules of operation that far simpler to be remembered when they only had a short time to think.

4. Discussion

The result showed that there were 26.53% of respondent gave the correct answer to the component of knowledge of and facility with numbers; 49.75% of respondent gave the correct answer to the component of knowledge of and facility with operations; and 42.19% of respondent gave the correct answer to the component of knowledge of and facility with numbers and operations to computational settings. The lowest performance was in the first component in which there was a need about mastering the conceptual understanding rather than the procedural understanding that could be found in the other components. This finding showed that most of the students were

more dominated by the procedural understanding than the conceptual one. Students' understanding was very related to the procedural understanding. If there was no conceptual understanding, it would be hard to observe and evaluate the error in the process of solving problems. This would lead to the error potential in developing the intuitive and conceptual understanding (Byrnes & Wasik, 1991; Widjaja, Stacey, & Steinle, 2008; Forrester & Chinnappan, 2010; Singh, 2009).

The weakness on the first component was in the sub-component of the sense of the order of numbers, which not more than 10% students answered correctly. There was a misconception that the students used their understanding of natural numbers to solve the fractions and decimals problems. Locating the natural numbers in the number line could be illustrated by placing the same-distanced dots on the number line, but this was different with fractions and decimal numbers. There would always be infinite number of fractions between every two fractions with different place value. This was the epistemological learning obstacle has to be anticipated by mathematics educators and researchers that the prior knowledge, which has been considered as the right concept and could be used in solving particular problems, later became inappropriate to be applied in solving new problems.

Moreover, there was also a misconception in understanding the concept of fractions in the sub-component of the sense of numbers representation. Holistically, students saw the part of fractions by counting the whole part without considering the concept of fair division. This was in line with the finding from Suryana, Pranata, and Apriani (2012) in five different schools in Indonesia which all students only saw the number of the shaded part without considering the fair division as mentioned above. The teacher has to be able to see this to create the various representations of fractions, for instance by using two models of both congruent and non-congruent fractions with concrete materials so that the students can understand that the concept of fractions is about the fair division.

The highest performance was found in the second component and the third one. However, the average of the second component was still below 50%. The lowest average was in the sub-component of understanding the nature of numbers. The students used to be more familiar with the written algorithm of operation and paid a little attention on the nature of operation. This would lead to the error in applying the algorithm in solving problems. It could also be seen that there was a close relationship between the procedural and conceptual understanding. The procedural computation could only be applied correctly with better conceptual understanding. This kind of problem was also found in the other second sub-component and most of the third sub-component.

Having showed the students' performance on the range of 26% to 50%, it could be concluded that students' number sense performance was low in the conceptual understanding. In addition, the teacher has to give more attention to the fractions and decimal domain. The result was closely related to the teaching materials the teacher chose. The instruction the teachers designed many times related to the teaching materials used in the classroom. When the teaching materials are dominated with the written rules and algorithm, the teachers tend to design the mechanistic approach in teaching so that the students are not facilitated to be a good problem solver. There are some suggestions in developing students' number sense that can be concluded from this study, such as: giving some activities that can support students' connection skills, exploring and discussing the concept, making sure that the order already suits the concepts, and connecting the problems to students' reality (Yang, 2002; Griffin, 2004; Yang & Wu, 2010). The suggestions given can be included into the instruction in the classroom or be integrated into the teaching materials.

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Effect of AsamKandis (*Garcinia xanthochymus*) Pulp in Decreasing Level of Mercury (Hg) and Plumbum (Pb) Content in Water Spinach (*Ipomea aquatica* Forssk)

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Abstract: Water spinach (*Ipomea aquatica* Forssk) is one vegetable plant that is consumed by people. Contamination of mercury (Hg) and lead (Pb) would cause health problems if it exceeds the allowable limit. The research aimed to determine the levels of mercury (Hg) and lead (Pb) content in water spinach from the plantation in Cakung Industrial Area in Jakarta and also determine variaous concentration of asamkandis solution that had most influence in decreasing levels of Hg and Pb content in water spinach. The research method was using wet and dry destruction, then the result ofthe destruction of the metal content was measured using Atomic Absorption Spectrophotometer (AAS) and analyzed using Indonesia standard method of SNI19-2896-1998andAOAC999.11/9.1.09.2005. Before immersion step, Hg level was 0,010mg/kg and Pb was0.070 mg/kg. After immersion step with asamkandis solution, highest decreases of Hg and Pb were obtained. Hg decreased up toof0.0080mg/kg(40.30%) andPb up to0.0400mg/kg(42.86%). It can be concluded that asamkandis can reduce the metal content and seem the citric acid responsible for it reducing capacity.
Keyword : Hg, Pb metals, Water spinach(*Ipomeaa quatica* Forssk), AsamKandis (*Garcinia xanthochymus*), Atomic Absorption Spectrophotometer(AAS).

Introduction

Waters area polluted by metal waste might be dangerous for living things. Certain metal were very dangerous if found in high concentration inside environment (water, soil, and air) because these metal could damage tissues of living things[1,2]. Environmental pollution by dangerous metals (Cd, Pb, Hg) might occurred if people or factories, that used the metal for production process, didn't care about environmental safety and monitor their waste that passed through river in which its water was used by people nearby for daily lives. Industrial area in Jakarta, such as Cakung Industrial Area, had automotive, logistic, and transportation rental industries which involve heavy metal in the production process. Many people plant variety of vegetable, one of it is water spinach. Apparently, water spinach was one of plants that was easy to absorb heavy metal from its growth media, while it was often consumed and was easily planted or grow in empty land near the river that was used for its water source [3]. Plants lived in water, such as water spinach, velvetleaf, lettuce, spinach, hyacinth, that were polluted by heavy metal would be biologically (bioaccumulation) accumulated into the plant's matrix tissues. Some heavy metals that often polluted river were Ca, Cd, Co, Cr, Fe, Ni, Pb, Hg. River pollution by Hg and Pb would cause contamination of nearby plants [4],were researches towards ability of some

plants to absorb heavy metal from polluted water. Green leafy vegetables have been recognizeed as rich source of micronutrients (minerals and vitamins) and antioxidants [5]. Water spinach (*Ipomoea aquatica* Forsk) is a vascular semi-aquatic plant native to tropics and subtropics that grow wild and sometime cultivated in Southeast Asia[6]. Water spinach is a herbaceous perennial plant belonging to the family *Convolvulaceae*, and commonly use this plant as food vegetables. The pericarp of asamkandis has been used for a long time in Sumatra island as a traditional medicine and food ingredient. In comparison to other fruits, asamkandis contains phenolic compounds, and organic acids, which makes it acidic[7]. According to research conducted, asamkandis contained major organic acid from leaves (1.7%), fruit (2.3%), and dried rind (12.7%). Most of its flavor was sour because it contained citric acid so that its pulp might be used to reduce metal level. [8]. The presence of the substance might also interact with metal that available apply for treatment of reducing content of heavy metal in vegetables.

Experimental

a. **Preparation of water spinach sample and asamkandis solution**.

Water spinach (*Ipomoea aquatica* Forssk) was first cleaned using fresh water. Then its leaves and young stem were separated and cleaned using aquadest. After that, water spinach was chopped, and about 15 gram of it was made for sample names before treatment. After that, it was immersed with asamkandis solution of various concentration (5%, 10%, 15%, 20^, and 25%)for 30 minutes.

b. Measurement of Hg and Pb metal level within sample

The sample which had been destructed was measured using Atomic Absorption Spectrophotometer (AAS) with result as follow; Hg's lambda was 253.7 nm and Pb was283.3 nm.

Data Analysis

Data resulted from the absorption process of sample and asamkandis solution shown in form of metal concentration. The metal level contamination within sample was measured using formula according to SNI 19-2896-1998 and AOAC 999.11/9.1.09.2005. [9]. The data of metal level contamination within sample was then formulated using linear equation.

Formula for counting metal level within sample (*recovery*) :

$$C = \frac{(D-E)\,xFP\,x\,V\,x\,{}^{1}/_{1000}}{W}$$

Note :
C was metal level (mg/Kg)
D was sample level from AAS reading result ($^{\mu g}/_{L}$)
E was blank level from AAS reading result($^{\mu g}/_{L}$)
V was final solution volume (mL)
W was sample's weight (gram)

Result and Discussion

1. Biological identification

Sample used in this research was water spinach. Water spinach is one of plants that could absorb metal pollution from nearby environment. It was taken from Cakung Industrial Area, East Jakarta, from one plantation at five growth points (four form corner and one from middle). Sample of water spinach was determination by LembagaIlmuPengetahuan Indonesia (LIPI) Biology Reaserch Centre in Cibinong, Bogor, Indonesia The sample used was identified as *Ipomoea aquatica* Forssk from family *Convolvulaceae*. Asamkandis was obtained from Ijem Herbal Company, Yogyakarta, Indonesia. Biological determination of asamkandis was conducted in LIPI Cibinong, Bogor, Indonesia and the plant used was identified as *Garcinia xanthochymus* from *Clusiaceae* clan.

1. Result analysis of Hg and Pb level in sample before treatment

The result analysis of mercury (Hg) and lead (Pb) level in sample before immersion with asamkandis solution was measured using Atomic Absorption Spectrophotometer (AAS). The result analysis could be seen in the following table:

Table 1. Result Analysis of Pb and Hg Metals Level in Sample before Treatment

Metal	Metal level (mg/Kg)		Mean	SD	%RSD
	I	II			
Hg	0.0147	0.0120	0.0134	0.0018	13.3596
Pb	0.0661	0.0739	0.0700	0.0018	5.5204

According to SNI 7387:2009, maximum tolerance level of Hg was 0.03 mg/kg and Pb was 0.5 mg/kg. Based on the result, metal level in water spinach sample from Cakung Industrial Area didn't exceed the maximum tolerance level. However, we need to concern that the metal content consumed might be accumulated within the body who consumed it. Therefore, it would be better if the metal content could be reduce so that it wouldn't be harmful for people who consumed it in large amount repeatedly in near time.

This research was conducted to reduce metal level of Hg and Pb in water spinach with various concentrations of asamkandis solution. As the result, for 30 minutes immersion, the highest decrease was found at 25% concentration. Hg reduced up to 0.0080 mg/Kg (40.30%) and Pb up to 0.0400 mg/Kg (42.86%)

2. Result analysis of Hg and Pb level in sample after treatment

The result analysis of decrease mercury (Hg) and lead (Pb) level in sample after 30 minutes immersion with various concentrations of asamkandis solution was measured using Atomic Absorption Spectrophotometer (AAS). The result analysis could be seen in the following table.

Table 2. . Result Analysis of Hg and Pb Level in Sample

Concentration of AsamKandis Solution	Hg Metal Level in Sample (mg/Kg)	Percentage of Decrease from Hg Metal Level	Pb Metal Level in Sample (mg/Kg)	Percentage of Decrease from Pb Metal Level
5%	0.0101	24.63	0.0531	24.21
10%	0.0104	22.39	0.0512	26.90
15%	0.0096	28.36	0.0480	31.43
20%	0.0089	33.58	0.0426	39.21
25%	0.0080	40.30	0.0400	42.86

From the table, the decrease was seen. It mean that citric acid contained in asamkandis could bind heavy meta; in sample as shown on the following curve:

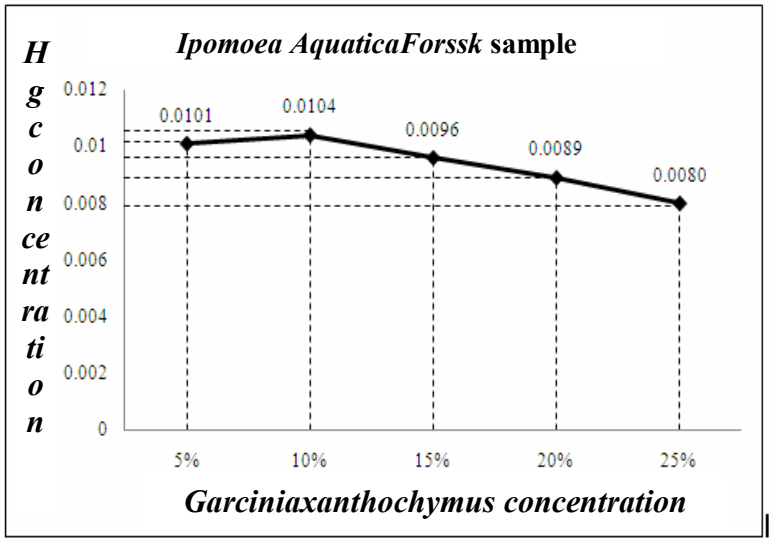

Figure 1. Mercury Level (Hg) Curve

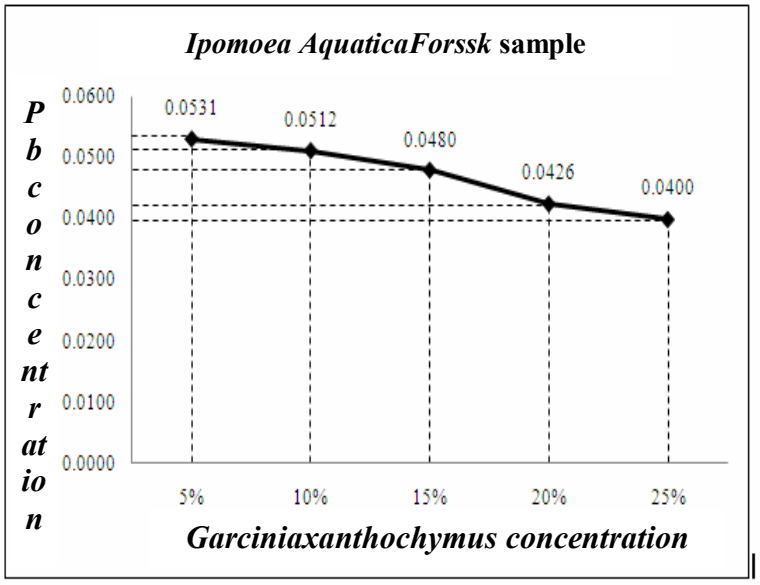

Figure 2. Lead (Pb) Level Curve

Asamkandis contained citric acid so that it might be useful as metal binder. Thereby, it might reduce metal level within sample.

To make asamkandis solution, it was measured and divided into various weights (5, 10, 15, 20, and 25 g). Each weight was then diluted slowly in 100 ml aquabidest. After that, it was stirred inside beaker glass until no powder agglomerated. Water from the stirring process was put into 100 ml measuring cylinder and added aquadest up to tera sign. As result, various concentrations of asamkandis solution were obtained; 5%, 10%, 15%, 20%, and 25 %. Citric acid was tricarboxylic which naturally found in fruits. Each of its molecule contained carboxyl cluster and one hydroxyl cluster which was bundled on carbon atom. Citric acid was very effective as metal binder. Carboxylyl ion was fine electron donor so that it might bound metal in form of complex electron bond [9]. Fresh water spinach, in which its leaves and young stem had been separated, was washed three times with clean water to remove dirt. It was then rinsed with aquadest tomake sure that no metal detected in the sample surface. After that, it was chopped and ready to be prepared. The sample was measured to 15 gram and so the immersion was conducted with concentrations of 5%, 10%, 15%, 20%, and 25 % for 30

minutes. Last it was dried and stored inside glass bottle so that metal level estimation; that was bounded with citric acid, could be obtained with reading by Atomic Absorption Spectrophotometer (AAS).

After that, two destruction procedures were conducted; wet and dry destructions. Destruction had function to cut bonding between organic compound and metal which would be analyzed. From the procedure, it was expected that only metal that would be left on sample. In this research, the two procedures were used according to SNI 19-2896-1998 to determine mercury (Hg) metal level either on water spinach or asamkandis solution. Wet destruction generally might be used to determine metal level, which couldn't stand heat. As for determining lead (Pb) metal level in asamkandis solution, wet destruction was also used because it wasn't possible to use hot destruction process which had to go through drying process by oven that would cause asamkandis solution to evaporate. In order to determine Pb metal level in water spinach, wet destruction was used to avoid dopants. Position when the sample was taken could have effect towards heavy metal level in water spinach. The closer to the spot where the water flow, would make heavy metal level in water spinach increased.

Hg and Pb wet destruction process used different technique and chemical material. This was in accordance with SNI 19-2896-1998. Hg wet destruction process was where subtle water spinach and asamkandis solution were measured less than 0.5 gram and added by 6 ml $HNO_{3(P)}$, 0.5 ml $H_2O_{2(p)}$. After that, it was left for 45 minutes, so that the plant tissue might perfectly decompose. Next, aquadest was added up to 15 ml scale. Then, it was heated at 90º C temperature for ± 5 hours. This heating process was aimed to avoid heavy evaporation. So then it was filtered using filter paper. Sample was next stored inside 50 ml volumetric flask and added by 2.5 ml HCl 16%. Last, aquadest was added up to border line. Thesolution was ready to be measured by Atomic Absorption Spectrophotometer (AAS). As for measuring Pb metal level within asamkandis solution using wet destruction, the solution was first measured to 10 gram. Htne it was stored in beaker glass and added by 5 ml $HNO_{3(P)}$, 5 ml HCl 6M, and 0.5 ml $H_2O_{2(P)}$. Afterward, it was heated for ± 30 minutes until it looked crystal clear and then left until it reached cool temperature. Next, it was filtered using filter paper; whatman no 42. Sample was then stored inside 50ml volumetric flask and aquadest was added up to border line. The solution was ready to be measured by Atomic Absorption Spectrophotometer (AAS).

Hg metal analysis needed *hybrid vapourgeneratorFlow Injection Analysis System* (FIAS) Perkin-100. This was because Hg evaporated easily. The Hg atomic gas was reacted in acid condition with $NaBH_4$, NaOH, and HCl by FIAS Perkin-100. After that, the absorbent reading was conducted using Atomic Absorption Spectrophotometer (AAS).

Water spinach lived in polluted media might absorb heavy metal nearby along with nutrition absorbed by its root. This was worrisome because water spinach was consumed by most people as nutritional and cheap food. It would be more dangerous if it consumed repeatedly for long time because it might accumulate in body. It could toxic or damage mental, behavior and cause anemia. At more severe toxic degree, it could cause vomiting and serious damage in neuron system, brain system damage and genetic abnormality.

Conclusion

Based on the research conducted, mercury (Hg) and lead (Pb) level in water spinach cultivated at plantation near Cakung Industrial Area, in Jakarta it was concluded that metal contamination in water spinach was still eligible to be consumed. Mercury (Hg) and lead (Pb) metal level in water spinach didn't exceed maximum limit according to SNI 19-2896-1998; Hg metal level was 0.03 mg/kg and Pb was 0.5 mg/kg.

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Association between Investment, Production, Export and Import: The Impact of Labor Force Absorption in Indonesia

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ABSTRACT *: This study produced several important findings, namely: (a) trade, especially foreign trade (exports and imports) and domestic production which increases the expansion of employment opportunities; (b) economic growth as measured by the growth of production and growth in investment showed an influence on the improvement of employment opportunities; and (c) Simultaneously, export, import, production and investment have a significant effect on employment. In connection with this, the Central Government of the Republic of Indonesia must continue to promote investment, especially sector Agroindustry and other agriculture-based industries, including fertilizer and pesticide industries. Imports of used clothing and used tires must be stopped to allow the national industry sector to recover profitable economic capacity. The agricultural sector must still get attention, especially food crops such as soybean, corn and rice and fruit to strengthen national food agriculture and agriculture-based industries as well as save on foreign exchange*

KEYWORDS : *Export, Import, Production, Investment and Labor Absorption*

I. INTRODUCTION

The integration of the world economy and trade policy is essential for development, job creation and poverty alleviation (Trade and Development Commission, UNCTAD, 2013). Foreign Direct Investment (FDI) has been shown to have encouraged local and regional economic growth, especially in developing countries in Asia, Africa and Latin America. It is to create jobs and alleviate poverty (Tambunan, 2005). The success of the economic development of a country is characterized by two main things, namely economic growth and poverty reduction. To alleviate this poverty, require job growth and an increase in income per capita (Jonaidi, 2012; Susilo, 2013).

Associated with the condition of Indonesia, a major problem faced is the phenomenon of labor surplus economy, a country which population growth is greater than the growth of their employment. Therefore, appropriate economic policies implemented in Indonesia are to encourage economic sectors which can immediately increase employment opportunities. The growth of industrial sector should be encouraged, especially subsector Agroindustry (agriculture based industries). The development of agriculture-based industries will contribute double benefits. In addition increasing the added value of agricultural products, agricultural employment and industrial sector will also increase. Along with it, the income of farmers is encouraged to increase in the future thus simultaneously reducing poverty.

According to Fei-Ranis models, shifting agricultural labor to the industrial sector took place in three stages based on the marginal physical product (MPP) and wages which assumed to be constant and exogenously determined. In the first stage, despite the transfer of power from agricultural sector to industrial sector, agricultural production will not fall because, agricultural laborers are redundant. In the second stage, the production of the agricultural sector began to decline because labor MPP had positive start. In the third stage is the stage of commercialization of the two sectors of the economy. MPP labor becomes higher than the level of wages. Agricultural producers will maintain its workforce thus each sector seeks to be streamlined. Transfer will continue to happen if the technological innovation in the agricultural sector can boost labor MPP (Kariyasa, 2006).Based on the ideas that have been put forward, then the following is the distribution of employment by economic sector:

Table 1. Employment by Industry and Status

Employment by Industry	2002	2005	2008	2011	2012
agriculture (%)	44.30	44.00	40.30	35.90	35.20
Manufacturing Industry (%)	13.20	12.70	12.20	13.30	13.90
Trading (%)	19.40	19.10	20.70	21.30	20.90
Services (%)	17.50	18.20	20.20	22.20	22.40
Others (%)	5.50	6.00	6.50	7.30	7.60
T o t a l	100.00	100.00	100.00	100.00	100.00
Employment by Status					
Freelance (%)	19.20	18.40	20.40	17.70	16.60
Assisted by Not Fixed Labor (%)	24.00	22.30	21.20	17.90	16.90
Assisted by Fixed Labor (%)	3.00	3.00	2.90	3.40	3.50
Labor / Employee / Servant (%)	27.30	27.70	27.50	34.40	36.40
Freelancer in Agriculture (%)	4.90	5.90	5.80	5.00	4.80
Freelancer in Non-Agricultural (%)	3.90	4.60	5.20	5.10	5.60
Work with Family / Unpaid (%)	17.60	18.00	16.90	16.40	16.20
T o t a l	100.00	100.00	100.00	100.00	100.00

Source: Indonesia Minimum Wage Policy (wcms_210427/BPS, 2013)

Table 1 has explained that there has been a transfer of labor from agriculture to other economic sectors. Employment in agricultural sector has decreased 5.6 percent per year, while other economic sectors had increased. The industrial sector increased by 1.3 percent, the trade sector rose 1.9 per cent, the service sector rose 6.4 percent and other economic sectors increased by 8.4 percent per year. In connection with that, this study aims to analyze the relationship between investment, production, exports, and imports as well as the Impact on Labor Absorption in Indonesia. This analysis is expected to answer the question, how much impact the growth of production and investment towards employment absorption capacity of the existing workforce.

There are three jobs that are the most widely demanded, there are laborers / employees / workers (average 30.66%). Helped by temporary workers are in average of 20:46 percent. Entrepreneur is in average of 18:46 percent. Indicating that being entrepreneur has not occupied a dominant position. This may be an indication that the entrepreneurs in Indonesia have been inadequate in number. To encourage adequate employment, the educational entrepreneurs must be fostered.

II. REVIEW OF LITERATURE

2.1. Investment

Investment is capital expenditure at the present time to obtain greater benefits in the future. Investments can be made using domestic investment and foreign investment. Investment through domestic resources derived from public savings and government savings. Sources in this country may be greatest if the community has the ability to set aside more of their income for consumption purposes. The level of income per capita that is low becomes a major obstacle in mobilizing public savings to finance investment. This caused the government must provide an opportunity for foreigners to invest. Investment is an important component in stimulating economic growth and creating jobs in a more sustainable manner. Investments can be created through the investment of domestic and foreign investment or foreign direct investment (FDI). Investments should be made on the leading sector, such as the manufacturing sector and Agroindustry. Foreign Direct Investment (FDI) plays an important role in enhancing the capacity of key sectors of the national economic, such as crude oil or some branch of the manufacturing industry sectors such as textiles and garments, footwear industry and service sectors such as telecommunications, transport and financial services (Cu Chi Loi , 2010).

Investing requires a conducive business environment and appropriate government policies. Currently, the effort to improve the business climate has been done but not optimal. Investments include all domestic spending by governments and the private sector aims to establish new factories, increasing capacity and quality of service industries, building economic infrastructure. Investment is the demand for goods and services to create or increase production capacity and revenue in the future (Dornbusch, Fischer & Startz, 2004).

Economic growth model which was developed from Keynes's theory focuses on the role of savings and investment. When an economy has the capacity savings, then these savings can be used for the capital for the achievement of economic growth of a country. There is a positive correlation between investment and economic growth (Arsyad, 2005; Harrod-Domar in Mukhlis, 2012). Another study found a high correlation between savings with investment (Feldstein & Horioka, 1980).The success of economic growth cannot be separated from the increasing investment. Investment is the rate of growth determinants. Besides, the output, the investment also will automatically increase the demand for inputs, which in turn will increase employment and social welfare. (Ma'mun & Yasin, 2003).

2.2. Production

Production capacity of an economy shows the limits of the economy to produce goods and services. Where all are used in full capacity. The number of jobs provided by the sector service industries related to all export activities that consider the relationship directly or indirectly carrying are larger than the total number of jobs created by all manufacturing exports (Relavan in Hengki Issakh Idris, 2013). Economic growth occurs when there is a rise in the real gross national product or national income rill. The economy is said to grow in case of real output growth. Economic growth which illustrates the increase in the standard of living measured by real output per person. Economic growth as a continuous rise in product per capita or per worker. It is often accompanied by the increase in population and usually also by structural changes (Todaro, 2003; Kuznets in Jhingan, 2004).

Economic growth showed the extent to which economic activity would generate additional income. Because basically economic activity is a process of using the factors of production to produce output (Mankiw, 2003). Some existing models, including models of neo-classical theory developed by Solow is a major growth in the 1960s designed to show how the growth in savings and capital stock, population growth, and advances in technology interact in economic growth. It also explains how they affect the total output of goods and services a country. This model states that the output depends on the capital stock and labor force. Assuming that the production process has a constant scale returns. Economic growth depends on the increase supply of factors of production; population, labor, and capital accumulation (Badrudin, 2012).

The model of growth as indicated by the equation Y = F (K, L) that national output is a function of the inputs used in the production process, which in this case is assumed to consist of capital factor (K) and labor factor (L). This function is an aggregate for connecting between the total economic output of the total amount of the two main factors that are used to produce the output (Solow, 1956). There are three factors or major component of economic growth. First, the accumulation of capital which includes all forms and types of new investments were invested in land, physical equipment and human resources. Second, population growth in the next few years by itself bring labor force growth. Third, advances in technology (Todaro, 2003). The indicators used to measure economic growth is the growth rate of Gross Domestic Product (GDP) (Mankiw, 2003).There are several underlying reasons for the selection of economic growth using Gross Domestic Product (GDP), which is that GDP is the total value added generated by all productive activity in the economy, this means an increase in the GDP also reflects an increase in remuneration to the factors of production used in the production activity.

2.3. Export and Import

The main factor that causes the direction of the flow of exports and imports is the improvement in the trade balance. Surplus trade balance on goods will be able to adequately cover the services trade deficit and the deficit in capital flows. Effect of increase in exports against imports are equal to the effect of increased investment against imports, but in terms of the balance of payments, the effect of changes in exports is not as big as the effect of changes in investment. Increased imports as a result of increased investment are usually not preceded by an increase in exports. Increase in exports is always tendentious to decreasing the balance of deficit payment, otherwise the decline in the value of exports has always resulted in increased deficits or declining balance of payments surplus. Improved trade balance requires rapid export growth.

2.4. The Employment

Population growth will clearly add to the number of items used, but the proportion will greatly depend on the increase in employment. If the population growth was accompanied by the increase in employment, it will be more receiving income. So that consumer purchasing power will increase. Labor is the one who do the work in order to produce goods or services to meet the needs of themselves and society (the Law of the Republic of Indonesia No. 13 of 2003).

Employment is one factor supporting economic development undertaken by developing countries aimed at creating equitable economic development. Based on the Law of the Republic of Indonesia Number 13 of 2003, Article 1, paragraph 2 defines employment as follows:*" Labor is any person who is able to work in order to produce goods and / or services to meet the needs of themselves and for society"* One attempt to improve employment is through the development in the industrial sector. Development in the industrial sector is part of a long-term effort to improve the unbalanced economic structure.

2.5. Labor Absorption

The level of relatively high population growth affects the growth of the labor force. The greater the number of working-age population, hence labor force will grow, both as workers and as a job seeker. The labor force is the workers who work and looking for work. Labor are all working age population (15-59 years of age according to the concept of ESCAP, 15-64 years according to the International concept and 10 years and over according to the concept of Indonesia (BPS, 2000). Finding a job is also called unemployed i.e. those who conduct job search. Job opportunities and unemployment can be calculated by using the following formula:

$$\text{Employment opportunity} = \frac{\text{Number of job}}{\text{Number of labor}} \text{ x k}$$

$$\text{Unemployment} = \frac{\text{Number of unemployed}}{\text{Number of labor}} \text{ x k}^1$$

Where: k = constant number (worth 100)

Labor Force Absorption Rate (LFPR) is the ratio of the number of labor force to the working age population (15 years and above). In this case the meaning of the labor force is the number of people working and looking for work. While the working age population is composed of the labor force and not the labor force, LFPR shows the magnitude of the working age population that is working and looking for work. The absorption rate of the labor force can be written:

$$TPAK = \frac{\Sigma AK}{\Sigma UK} \text{ x } 100\%$$

Where:
Ak = Labor force,
UK = Working age population.

The labor force consists of employed and unemployed population. While that is not the workforce is comprised of people who in the reference period does not perform economic activities, either because of school, taking care of the household or the other. While the definition of working is doing activities with the intent to obtain or help earn income for at least one hour a week. Worked for an hour should be done consecutively and uninterrupted. Unemployment includes people without working, looking for work, preparing for a new business or have been accepted to work but have not started working. Looking for work defines as the effort which is made to obtain a job at one period of reference.

III. METHODS

This research was conducted by using survey method. The data used is secondary data collected through research documents in the National Central Bureau of Statistics in Jakarta. Data were analyzed using correlation and multiple regression analysis (Ghozali, 2005). The value of each variable analysis of the algorithm values previously withdrawn, except with respect to the analysis of growth.

The design of the research model is as follows:

$$\mathbf{Log\ Y = b_o + b_1 LogX_1 + b_2 LogX_2 + b_3 LogX_3 + b_4 LogX_4 + e_i \ldots\ldots\ (a)}$$

$$\mathbf{\Delta Y = b_o + b_3 \Delta X_3 + b_4 \Delta X_4 + e_i \ldots\ldots\ (b)}$$

Where :

Log Y = absorbed labor

Log X_1= exports value

Log X_2= imports value

Log X_3= production value

Log X_4= investment value

ΔY = changes in absorption of labor

ΔX_3= production growth

ΔX_4= investment growth

ΔY = $\frac{Y_t - Y_{t-1}}{Y_{t-1}}$ x 100, and the same process is carried out in calculating ΔX_3 and ΔX_4. Y_t= labor absorption in year into t, and Y_{t-1}= labor absorption in the previous year.

In addition, the data were also analyzed by using multiple correlation analysis with the intention to measure the relationship of independent variables studied with labor is absorbed. Regression analysis was performed as a measure of the effect of each independent variable analyzed toward labor absorbed.

IV. RESULT

Results of multiple correlation analysis of the model (a) generating correlation values in Table 2.

Table 2.
Multiple Correlation Analysis Log Y = f(LogX_1, LogX_2, LogX_3, LogX_4)

No	Variables	Log Y	Log X_1	Log X_2	Log X_3	Log X_4	p-value
1	Log Y	1					-
2	Log X_1	0.959	1				0.000
3	Log X_2	0.928	0.980	1			0.000
4	Log X_3	-0.780	-0.854	-0.847	1		0.001
5	Log X_4	-0.325	0.441	-0.169	0.917	1	0.236

Source: Data analyzed by SPSS of Appendix 1

Based on the correlation values in Table 2, it can be seen that the export, import and production are correlated significantly with workers absorbed. There are only investment is not significantly correlated. In addition, the interesting thing is the negative relationship between production (X_3) and investment (X_4) with workers absorbed (Y). This means that the increase in exports and imports encourage increased labor force. As with the production and investment, has the opposite behavior. This occurs because the industrial sector in Indonesia is still using imported raw materials and the investment has not focused on agriculture-based industry (domestic resources). To explore the behavior of variable causality analysis, the following are presented results of the regression analysis, simultaneously and partially.

Table 3. Analysis of Simultaneous Variables

ANOVA [b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.015	4	.004	37.358	.000[a]
	Residual	.001	10	.000		
	Total	.016	14			

a. Predictors: (Constant), LogX4, LogX3, LogX2, LogX1

b. Dependent Variable: LogY

Source: Data analyzed by SPSS of Appendix 1

Data Table 3 shows that simultaneously analyzed four independent variables that significantly influence the absorption of labor in various jobs. But partially, the conditions are presented in Table 4.

Table 4. Results of Analysis of Partial Independent Variable

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.506	.659		8.358	.000
	LogX1	.202	.074	1.185	2.729	.021
	LogX2	-.023	.050	-.188	-.456	.658
	LogX3	.002	.005	.075	.471	.648
	LogX4	-.017	.014	-.104	-1.202	.257

a. Dependent Variable: LogY

Source: Data analyzed by SPSS of Appendix 1

Analysis according to Table 4 generates the regression equation:

$$\mathbf{Log\ Y = 5.506 + 0.202\ LogX_1 - 0.023\ LogX_2 + 0.002\ LogX_3 - 0.017\ LogX_4.}$$

Table 4 shows that only exports are already having positive and significant impact. Although not significant in the production, but positive influence is on the export of labor absorption instead. As with the import and investment showed a negative relationship and influence, meaning that an increase in imports would result in a weakening of the economic absorptive capacity of the labor sector. Investment also showed the same behavior. Thus, some improvements in the field of investment policy are necessarily needed. Investment should be encouraged spaciousness effort to stimulate and encourage the development of export-based growth of the domestic industry and strengthen agriculture. ,Viewed from the angle of the impact of growth in domestic production and investment, hence the results of analysis are presented in Table 5.

Table 5. Impact of Production Growth and Investment

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.796	.288		6.227	.000
	pertumbuhan	.008	.007	.275	1.058	.313
	investasi	.008	.005	.426	1.638	.130

a. Dependent Variable: serapan

Source: Data analyzed by SPSS of Appendix 1.

Based on data from Table 5, obtained a regression equation:

$$\mathbf{\Delta Y = 1.796 + 0.008\Delta X_3 + 0.008\Delta X_4}$$

Growth of Production and Investment Enhancement does not significantly influence the increase in labor absorption. However, the correlation and the effect were positive. Meaning that, there is the relationship and influence between production growth and development investment to increase labor absorption. These results indicate the need for central government support Indonesia in the field of real sector and investment. Business field should be developed is the field that is able to accelerate the rapid growth of employment. Business field should be encouraged is agriculture-based industries (Agroindustry).

Posture study variables can be seen in Figure 1.

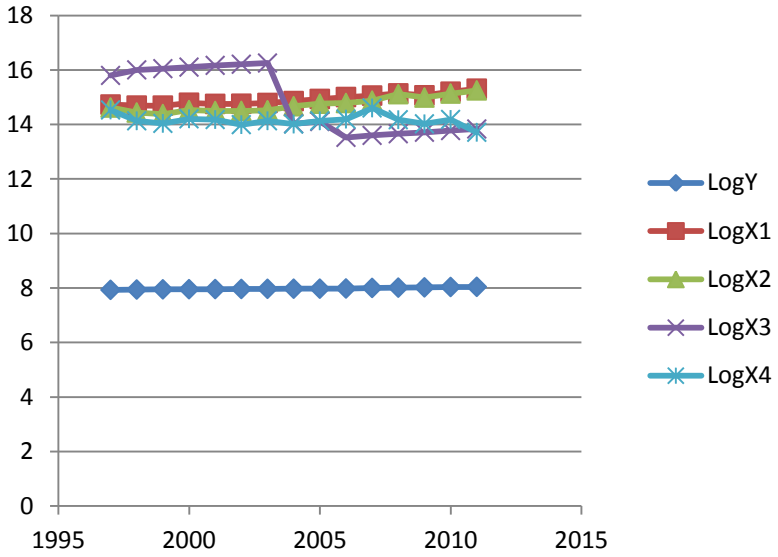

Figure 1. Variable Research Visual

Figure 1 illustrates that the actual export and import measured in rupiah in the period 1997-2011 is likely to increase. The value of production in the same period, precisely from 2004 to 2011 continued to decline. The symptoms are also seen in investment, though the decline of investment was not as big as production.

V. DISCUSSION

The analysis showed the relevance of the findings showed that investment in the form of FDI and economic growth affect the expansion of employment opportunities (Tambunan, 2005; Jonaidi, 2012; Susilo, 2013). The trade impact on a country's strong economy and its effect on employment (UNCTAD, 2013). The study also found that the trade, especially foreign trade (exports and imports) correlates strongly and positively with employment. The shift of labor to the agricultural sector and other economic sectors tend not to reduce agricultural production. Even it will increase the economic productivity (Kariyasa, 2006).

During the study period, it has been proven that the agricultural sector workforce has shifted to other economic sectors, such as manufacturing sectors, trade and services. But such a shift is followed by specific agricultural production, especially soybean and fruits. However, labor mobility agriculture and other economic to sector will still take place due to the attractiveness of wages in other sectors of the economy. Thus, the employment in manufacturing sectors needs to be increased. Only a shift in power agricultural sector must be followed with the right policy. Modernization of the agricultural sector needs to be done. Modernization of the agricultural sector needs to be done by giving priority to the development of agroindustry and agribusiness (Kurniati & Yanfitri, 2010). Harrod-Domar theory sees the need to mobilize the community to increase the potential savings. Increased savings need to be followed by an increase in investment, particularly investment in the sector Agroindustry. All of these will encourage the expansion of employment opportunities (Rahayu, 2014). Businesses prosper society must start from the provision of employment opportunities for all residents.Through employment, people will earn sufficient income to meet the educational needs of children, health care and simultaneously increase income per capita. The constructive effort would be useful for eradicating the poverty (Khan, 2007). The findings of this study support the results of previous study that the Agroindustry sector needs to be developed as well as enhancing the investment. It will promote the development of labor absorption sectors of industry and agriculture.

VI. CONCLUSION AND RECOMMENDATIONS

Based on the results of the analysis can be concluded that trade (exports and imports) along with production is useful to increase employment opportunities. Economic growth is measured by the growth in production and investment growth shows its effect on increasing employment opportunities. Simultaneously, exports, imports, production and investment have a significant effect on employment.

Indonesian government is urged to keep encouraging investment, especially sector Agroindustry and other agriculture-based industries, including fertilizer and pesticide industries. Imports of used clothing and used tires must be stopped to allow the recovery of the industrial sector to do business profitably economic capacity. The agricultural sector must still get attention, especially food crops such as soybean, corn and rice, and fruits. It is intended to strengthen the national food agriculture and conserve foreign exchange.

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Appendix 1.

Export, Imports, Production, Investment and Labor Absorption

Year	Export (Rp)	Imports (Rp)	Production (Rp)	Investment (Rp)	Labor (People)
1997	534436000000000	416798000000000	6276955190000000	338444872900000	85050000
1998	488476000000000	273369000000000	10023330000000000	135691749300000	87290000
1999	486655000000000	240033000000000	11099795000000000	108959550000000	88820000
2000	621240000000000	335148000000000	12649187480000000	160851327700000	89840000
2001	563209000000000	309621000000000	14676548350000000	150617672900000	90810000
2002	571588000000000	312889000000000	16105649510000000	97916307600000	91650000
2003	610582000000000	330859000000000	17866909190000000	136012092100000	92810000
2004	715846000000000	465245000000000	106100810000000	102835140400000	93720000
2005	856600000000000	577009000000000	127048390000000	135490576400000	93960000
2006	1007986000000000	610655000000000	33392168000000	156342767200000	95460000
2007	1141009000000000	744734000000000	39508932000000	401646870300000	99930000
2008	1370204000000000	1291974000000000	45513587000000	148734303400000	102550000
2009	1165100000000000	968292000000000	51414144000000	105190799900000	104870000
2010	1577791000000000	1356633000000000	59362378000000	152195525300000	108210000
2011	2034966000000000	1774356000000000	67943734000000	51323022400000	109670000

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Direct cortical hemodynamic mapping of somatotopy of pig nostril sensation by functional near-infrared cortical imaging (fNCI)

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ABSTRACT

Functional near-infrared spectroscopy (fNIRS) is a neuroimaging technique for the noninvasive monitoring of human brain activation states utilizing the coupling between neural activity and regional cerebral hemodynamics. Illuminators and detectors, together constituting optodes, are placed on the scalp, but due to the presence of head tissues, an inter-optode distance of more than 2.5 cm is necessary to detect cortical signals. Although direct cortical monitoring with fNIRS has been pursued, a high-resolution visualization of hemodynamic changes associated with sensory, motor and cognitive neural responses directly from the cortical surface has yet to be realized. To acquire robust information on the hemodynamics of the cortex, devoid of signal complications in transcranial measurement, we devised a functional near-infrared cortical imaging (fNCI) technique. Here we demonstrate the first direct functional measurement of temporal and spatial patterns of cortical hemodynamics using the fNCI technique. For fNCI, inter-optode distance was set at 5 mm, and light leakage from illuminators was prevented by a special optode holder made of a light-shielding rubber sheet. fNCI successfully detected the somatotopy of pig nostril sensation, as assessed in comparison with concurrent and sequential somatosensory-evoked potential (SEP) measurements on the same stimulation sites. Accordingly, the fNCI system realized a direct cortical hemodynamic measurement with a spatial resolution comparable to that of SEP mapping on the rostral region of the pig brain. This study provides an important initial step toward realizing functional cortical hemodynamic monitoring during neurosurgery of human brains.

Introduction

Functional near-infrared spectroscopy (fNIRS) is a rapidly developing neuroimaging technique for the noninvasive monitoring of human brain activation states (Ferrari and Quaresima, 2012; Hoshi, 2005, 2007; Scholkmann et al., 2014; Wolf et al., 2007). It utilizes the tight coupling between neural activity and regional cerebral hemodynamics (i.e., neurovascular coupling) to measure signals reflecting concentration changes of oxygenated and deoxygenated hemoglobin (oxy-Hb and deoxy-Hb) (Obrig and Villringer, 2003). fNIRS is classified as a transcranial neuroimaging modality where illuminating light sources and detecting probes (called optodes) are placed along the scalp to measure cortical hemodynamic signals underneath. Photons emitted from a light source travel along the scalp tissues, consisting of skin, the skull, cerebrospinal fluid and the cortex, and only a small portion of the photons are scattered and reflected back to the detector. The path of the traveling photons is often described as banana-shaped, but simulation studies on photon migration have clarified that the detected photons mostly travel along the cortical surface (Okada and Delpy, 2003a, 2003b; Okada et al., 1997). Therefore, an fNIRS channel, defined as a pair of illuminating and detecting optodes, should cumulatively provide cortical hemodynamic signals from the tissues located between and around the optodes.

The nature of the light propagation restricts the spatial resolution of fNIRS measurements. When the distance between the illuminating and detecting optodes is too small, the illuminated photons are detected before they reach the cortex. Thus, a too short inter-optode distance, such as under 2 cm, is usually avoided (Germon et al., 1999; Okada et al., 1997). Accordingly, in a typical multichannel optode setting with an inter-optode distance of 3 cm, the spatial resolution as defined by center-to-center distance of channels is 2.1 cm (i.e., $\sqrt{2}/2$ times the inter-optode distance of 3 cm).

On the other hand, there have been ongoing efforts to improve the spatial resolution of fNIRS. This has mainly been implemented through introducing overlapping optodes at higher geometrical density. One

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method is when two fNIRS optode sets with 3-cm inter-optode distances are placed alternately to have two overlapping images 1.5 cm offset to each other. This is called double density optical topography, leading literally to doubled spatial resolution (Kawaguchi et al., 2007; Yamamoto et al., 2002).

The other more often implemented method is called diffuse optical tomography (DOT), which utilizes image reconstruction from multiple optodes placed differentially at relatively long-distances (Barbour et al., 1995; Bluestone et al., 2001; Boas et al., 2004; Culver et al., 2003). DOT utilizes prior information on tissue composition of a subject's own head or from a canonical atlas (Custo et al., 2010) to first perform a photon migration simulation among tissues irradiated by illuminators (forward problem). Subsequently, signal source, or cortical activation, is assumed so as to best explain the observed signals detected in differentially placed optodes (inverse problem). By integrating signal source information obtained from different channels, a three- or two-dimensional continuous image is created. This has a higher resolution than optode distance, and provides spatial resolution at a dozen millimeters, which is sufficient for retinotopic mapping (Zeff et al., 2007).

In a sense, the evolution of fNIRS seems to follow that of its preceding transcranial modality, electroencephalogram (EEG). EEG has a long tradition of multiple discrete channel measurement where electrodes are placed at distinct cranial landmarks usually defined using the international 10–20 system or its variants (Chatrian, 1985; Jasper, 1958; Jurcak et al., 2007; Oostenveld and Praamstra, 2001; Tsuzuki and Dan, 2013). A high-density electrode setting (typically above several dozen; Suarez et al., 2000) can also lead to signal source estimation and subsequent image reconstruction, most exemplified in a technique called LORETA (Pascual-Marqui et al., 1994). As with DOT, LORETA utilizes a combination of forward and inverse problems to create a continuous image of the neural activity of the brain.

In another direction, EEG has evolved into the Electrocorticogram (ECoG) where EEG electrodes are not placed on the scalp but rather directly on the cortical surface to measure neural activity of the cortex in situ (Hashiguchi et al., 2007). Albeit invasive, ECoG provides robust information of the neural activity of the cortex at higher spatial resolution than EEG since directly placed electrodes do not suffer from signal attenuation and diffusion inevitably involved in any transcranial measurement. For example, ECoG with a microelectrode array can detect microdischarges resembling epileptiform activity or seizures recorded from a confined area of 0.2 mm^2 (Schevon et al., 2008; Stead et al., 2010).

As a logical extension of the overall evolutionary picture of fNIRS and EEG, researchers started to pursue direct cortical measurement using fNIRS. Using time-resolved spectroscopy, Elliott et al. (2013) examined DTOF (distributions of times-of-flight of photons) changes in adult pigs injected with indocyanine green (ICG) directly and transcranially, and confirmed changes of cerebral blood flow during normocapnia and hypocapnia in both measurements. Moreover, Keller et al. (2011) developed a novel brain tissue probe enabling simultaneous monitoring of intracranial pressure (ICP), CBF and cerebral blood volume (CBV). The probe was placed into the brain tissue of a patient with severe subarachnoid hemorrhage. By injection of ICG, they confirmed that CBF and CBV could be calculated with this method. Furthermore, using measurement devices containing two detectors, two illuminator, and two ECoG electrodes, Osharina et al. (2010) measured hemodynamic changes (oxy-Hb increase and deoxy-Hb decrease) during and after epileptic spikes induced by administration of bicuculline methiodide (BM) onto the sensorimotor cortex. They confirmed the presence of a focal hemodynamic response starting before the spike activity. Similarly, a device enabling concurrent measurement of fNIRS and EEG was placed directly on the rat cortical surface, leading to the measurement of hemoglobin signal changes induced by hyperoxia and brain cooling (Yamakawa et al., 2014). From these pioneering contributions, it is expected that fNIRS can measure hemodynamic changes associated with sensory, motor and cognitive neural response directly from the cortical surface. If such direct measurement is made possible, it is further expected that direct fNIRS measurement on the cortical surface can resolve the cortical hemodynamic activation pattern at a higher resolution than can transcranial fNIRS measurement, and thus can generate a high resolution topographic representation of the focal cortical activation patterns.

Here, we introduce functional near-infrared cortical imaging (fNCI), which enables the direct measurement of cortical hemodynamics. The fNCI system is based on a typical continuous light fNIRS system, but each illuminator-detector optode pair is placed alternately in a grid array at 5 mm apart. To avoid light leakage that may travel in a shortcut manner from an illuminator to a neighboring detector, we made a light-shielding probe holder to enclose probes. The holder had a small hole at the bottom to allow light penetration to the cortical tissue. This configuration was also designed to adjust the amount of light emitted and to avoid signal saturation at the detecting optode.

We validated the fNCI system in a direct cortical measurement using miniature pigs. Since the somatotopy of pig nostril sensation is well described in the rostral region of the pig brain, we could assess whether functional mapping using fNCI was successful by comparing it with somatosensory-evoked potential (SEP) measurements performed either sequentially or simultaneously. Taken together, these measurements provide experimental evidence for the applicability of direct functional measurement of cortical hemodynamics using the fNCI system, and we hope that this provides the first step toward realizing the future application of fNCI in functional neurosurgical monitoring.

Materials and methods

Animal preparation

In total, 20 Mexican hairless pigs were used including 17 animals used for preparatory experiments. The current study focuses on the main experiment using three male Mexican hairless pigs with weights and ages of 23.0–28.6 kg and 8–13 months. All animals were kindly supplied by Ibaraki Station, National Livestock Breeding Center, Chikusei, Ibaraki, Japan. All animals received humane care as described in the US National Institute of Health's Guide for the Care and Use of Laboratory Animals. The experiments were approved by the Institutional Animal Experiment Committee of the Jichi Medical University.

Anesthetic protocol and surgical preparation were performed as described in a previous paper (Saito et al., 2013). In brief, pigs were sedated by an intramuscular injection of medetomidine (60 μg/kg; Zenoaq, Fukushima, Japan) with midazolam (0.3 mg/kg; Astellas Pharmaceuticals, Tokyo, Japan) and then atropine (20 μg/kg). They were anesthetized with sevoflurane (2%–3%; Mylan Pharmaceuticals, Tokyo, Japan), and held on a stereotaxic frame in the prone position, which kept the head and measurement instruments in the appropriate positions. During the experiment, the animals were mechanically ventilated and received a continuous intravenous drip of warm lactate-Ringer buffer solution. The vital signs were monitored continuously and kept as constant as possible. The level of anesthesia was adjusted so as not to awaken the animal during the electrical stimulation described below.

A craniectomy was performed to expose the activation area as follows; in the medio-lateral direction: from the sagittal suture 20 mm laterally, and in the anterior–posterior direction: from the line connecting the lateral canthi 60 mm caudally (Fig. 1A). Dura mater was sectioned to expose the surface of the brain.

Stimulation

A pair of bipolar electrodes (ball-tipped Ag–AgCl electrodes insulated except at the tip) was attached around the nostril on one side of the snout. One side of the nostril was vertically divided into 3 areas: top, middle and bottom. Stimulation points were determined in each area. It has been reported that stimulation to each area evokes activation in

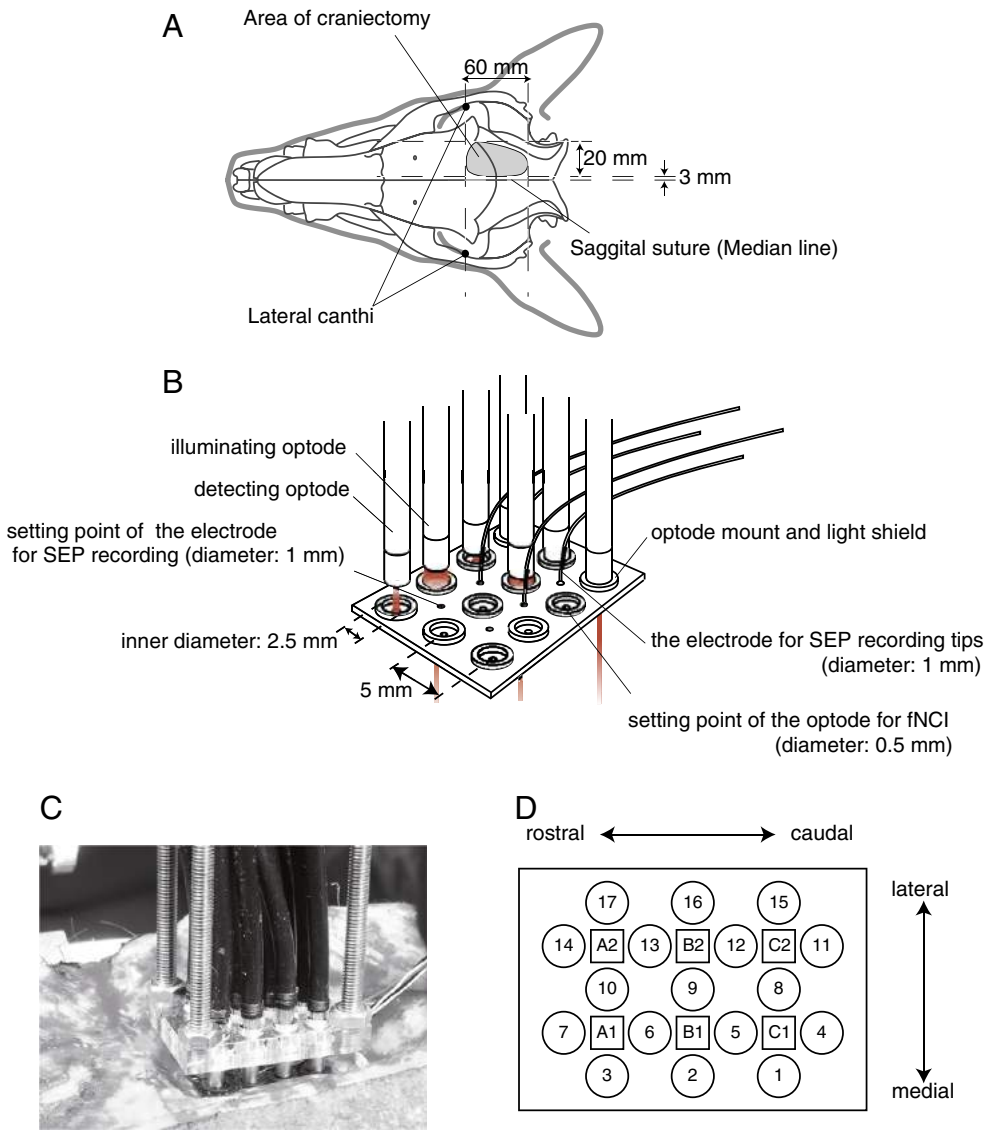

Fig. 1. Images of experimental setup. A: top view of skull structure and head outlines. Black filled circles indicate both lateral canthi. The gray area represents the region of the craniectomy. B: the formation of the black rubber sheet and arrangement of optodes and electrodes. There are ridges around the holes the optode tips can be mounted. Finally, 6 electrodes are fixed to the sheet and 12 optodes are tightly inserted. C: a photograph of the optodes, the black rubber sheet and the optode holder. D: the arrangement of measuring points. Squares indicate SEP measurement points, which were same as the electrode arrangement. Circles indicate fNCI measuring points, which were located between illuminating and detecting optodes.

different parts of the primary somatosensory area (Craner and Ray, 1991).

Electrical stimulation was delivered to the electrodes from the Neuropack S1 EMG/EP system (MEB-9404, Nihon Koden, Tokyo, Japan) as constant rectangular current pulses with an intensity of 10–15 mA, a duration of 0.3 ms, and a frequency of 3 Hz for SEP mapping or 4 Hz for simultaneous recording of fNCI and SEP.

SEP mapping

Before the fNCI recording, we did SEP mapping with the stimulation at each point in the nostril. We used a 1-mm thick silicone rubber sheet with 1-mm diameter holes in 2.5-mm pitch lattice formations (Saito et al., 2013). The recording electrodes were set in the holes of this sheet. We recorded SEPs on the 2.5-mm pitch lattice formations. Neuropack S1 derived stimulation and amplified measured potentials. For SEP mapping, stimulation rate was 3 Hz and SEP were averaged 50 times for each point.

Recording sequence for simultaneous measurement using fNCI and SEP

Each stimulation sequence consisted of an inter-stimulation rest period randomly set at between 20 and 30 s, and stimulation periods of 15 s. The stimulation sequence was repeated ten times. The total time of one measurement sequence was 390–480 s. Stimulation was set at 4 Hz for concurrent measurements.

fNCI system

The fNCI system was built on the optical topography system (ETG-100, Hitachi Medical Corporation, Tokyo, Japan). This system uses a semiconductor laser emitting near infrared rays (780 nm and 830 nm). The trigger signal to the ETG-100 and the Neuropack S1 was sent from a PC, and the stimulation and recording were started synchronically.

Six pairs of illuminating and detecting optodes were alternately arranged in a 3 by 4 array with an inter-optode distance of 5 mm. The outer diameter of the optode tip was 2.5 mm and the diameter of the optical fiber was 1.8 mm. To place the optodes directly on the cortical

surface, we used a black, light-shielding rubber sheet with 18 holes (Fig. 1B). Twelve of 18 holes were placed to accommodate the optode layout, and there were ridges around each hole to prevent light from leaking laterally from the optodes (Fig. 1B). Each hole was 0.5 mm in diameter, and each ridge was 1 mm in width and 2.5 mm in inner diameter. The tip of an optode fit exactly within the ridge. The remaining 6 holes corresponded with the intermediate point of each set of four optodes' holes to set Ag–AgCl electrodes for recording SEP. Each of these holes was 1 mm in diameter. The black rubber sheet was set on the lateral cortical surface and 1 optode or electrode was set in each hole, for a total of 12 optodes and 6 electrodes (Figs. 1C, D).

We analyzed the optical data based on the modified Beer–Lambert Law (Cope et al., 1988) as previously described (Maki et al., 1995). Oxy-Hb signals were mainly used for statistical analyses due to its higher signal amplitude than that of deoxy-Hb (Strangman et al., 2002).

Data analysis for fNCI mapping

Individual timeline data for the oxy-Hb signal of each channel were analyzed using the General Linear Model (GLM) with regression to a hemodynamic response function (HRF) as modified for fNIRS by Schroeter et al. (2004) and Plichta et al. (2007). This approach is compatible with typical fMRI analyses.

Properly measured individual timeline data for the oxy-Hb signals of each channel were preprocessed by the Wavelet minimum description length (Wavelet-MDL) detrending to remove global trends due to breathing, cardiac movement, vasomotion and other experimental errors (Jang et al., 2009) and by temporal smoothing with convolution of the canonical HRF to the individual timeline data (Friston et al., 2000). Changes in the autocorrelation structure of the timeline data due to temporal smoothing were adjusted using the pre-coloring method (Worsley and Friston, 1995), which has also been shown to be adequate for fNIRS analyses (Ye et al., 2009). The pre-coloring method adjusted the degree of freedom.

In this study, adaptive methods were used to find the optimal HRF for temporal analysis of fNCI data (Sano et al., 2012). To adjust for possible variation of hemodynamic responses due to anesthetic depth among the animals, the GLM with regression to temporally variable HRFs was applied to fNCI data for each animal. The following HRF $h(\tau_p, t)$ was used according to Friston et al. (1998).

$$h\left(\tau_p, t\right) = \frac{t^{\tau_p} e^{-t}}{\left(\tau_p\right)!} - \frac{t^{\tau_p+\tau_d} e^{-t}}{A\left(\tau_p + \tau_d\right)!}$$

where τ_p stands for the first peak delay and was set as a variable changing from 6 to 20 s to yield variable HRF. In typical fMRI studies, τ_p is usually fixed to 6 s. τ_d is the second peak delay and was set to 10 s as in typical fMRI studies. A is the amplitude ratio between the first and second peaks and was set to 6 as in typical fMRI studies. Basis functions $f(\tau_p, t)$ were generated by convolving variable HRF $h(\tau_p, t)$ with a boxcar function $N(t)$.

$$f\left(\tau_p, t\right) = h\left(\tau_p, t\right) * N(t).$$

In addition, the temporal and dispersion derivatives of the canonical HRF were included to adjust the onset and dispersion of the model functions to the individual's hemodynamic response. A bias component was also included.

The normalized β-values and t-value of the oxy-Hb signal were estimated for the variable HRF predictor. These values were calculated using a least-squares-model fitting procedure maximizing model-to-data fitting (Bullmore et al., 1996a, 1996b). A p-value of less than 0.05 was considered significant. Family-wise errors due to multichannel measurement were subjected to Bonferroni correction. To examine the effects of τ_p, average t-value over 17 channels and 3 measurements (3 stimulation patterns) were calculated for all τ_p, values tested. The τ_p, values that yielded the maximum average t-value were adopted.

The optimal τ_p was 16, 8 and 6 s for each animal. Based on these τ_p values, the t-value of each condition and each individual was calculated.

In Fig. 2, the fitted curve and measured values for each stimulation set of one individual are illustrated as examples. The measured values were filtered, averaged over 17 channels and 10 stimulation sets, adjusted to baselines and normalized. The fitted curve was the average of 10 stimulation sets.

The fNCI mapping was performed by in-house MATLAB toolboxes that are available through our website (http://brain-lab.jp).

Fusion of SEP and fNCI

We defined the location where the strongest response was obtained for the stimulation as the active point. In order to determine the coordinates of the active point for SEP, we made an isopotential map and selected the point of maximum value. The active point for fNCI measurement was similarly determined as the point of maximum value of the isogram map of normalized β-values. Coordinate values of fNCI optodes were translated to those based on the arrangement of SEP electrodes. The positional relationship between the SEP and fNCI sheets were merged using a photograph.

Results

Simultaneous measurement for fNCI and low-resolution SEP

We measured SEP from six points (2 by 3 each separated by 5 mm) at the rostral region in the primary sensory area of miniature pigs by stimulating the nostril (Fig. 1). The stimulations were applied to three different points, which were separated by approximately 20 mm on the skin surface (Fig. 3A). The reproducible SEP activities were measured and the maximum peak-to-peak value was measured from different electrodes for the different stimulation points. Fig. 3B shows the SEP waves, which were simultaneously recorded by fNCI from the brain surface. These waves had large positive potentials at around 15 ms, followed by negative potentials at around 20 ms. Calculated active points are overlaid on the brain surface image as squares (Fig. 3D).

Simultaneously, we took fNCI measurements. The measured waveforms of oxy-Hb and deoxy-Hb for fNCI channels with the largest t-values are shown in Fig. 3C. These waveforms are similar to those common in fNIRS measurements. The values of oxy-Hb (red line) and deoxy-Hb (blue line) changed from the baselines several seconds after

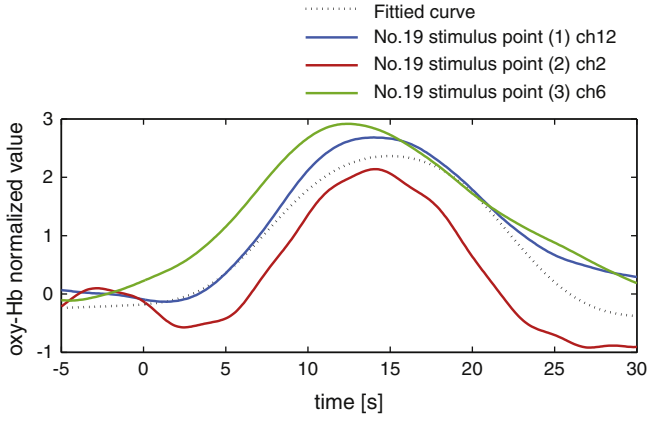

Fig. 2. Fitted curve and measured values of oxy-Hb for each stimulation set for one individual. Blue, red, green lines indicate the measured values for stimulation points (1), (2), and (3), respectively. The black dotted line indicates the fitted curve.

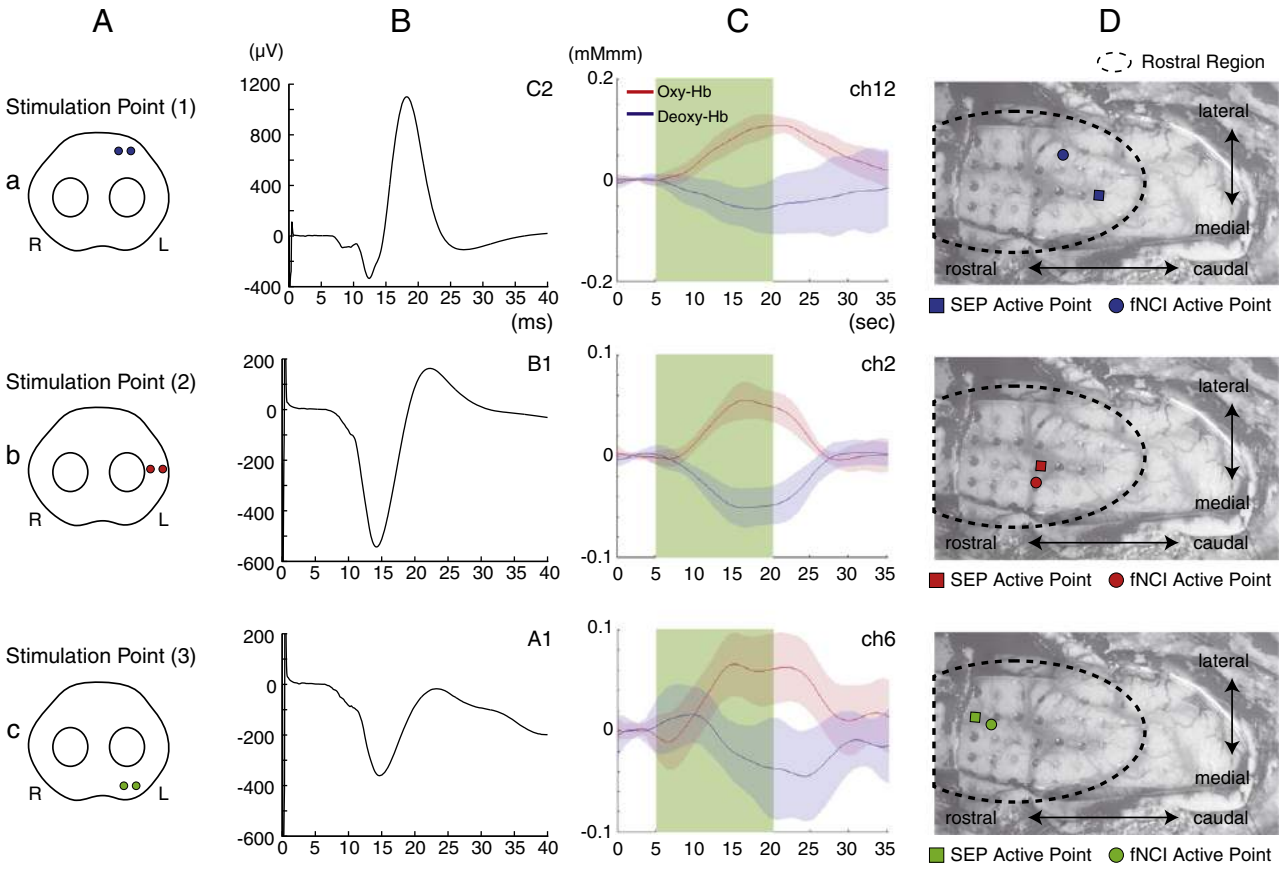

Fig. 3. The active points and waveforms of SEP and fNCI. A: positions of the stimulation points. A-a: top area of the nostril. A-b: middle area of the nostril. A-c: bottom area of the nostril. B: a sample wave of SEP for the measurement point at which the largest peak-to-peak potentials were recorded. The electrode arrangement is shown in Fig. 1D. C: a sample wave of fNCI for the measurement point with the maximum t-value. Red lines indicate the value of oxy-hemoglobin, and blue lines indicated the value of deoxy-hemoglobin. The solid line indicates the average of 10 measurement sets, and translucent areas show the SD. The stimulation periods are indicated by the green background. D: active points by stimulation at the positions indicated in A. Colored squares indicate SEP active points and colored circles indicate fNCI active points. The dashed line indicates the rostral region that corresponds to the primary sensory area of the nose.

the start of stimulation. The oxy-Hb showed an upward tendency and deoxy-Hb showed a downward tendency. These peaked in 8 to 10 s.

SEP and fNCI active points for each stimulation point were located near one another within the rostral region. Both SEP and fNCI active points shifted from the caudal part of the rostral region to the rostral part as the stimulation point moved from the top to the bottom of the nostril.

In order to evaluate measured values, significant t-values ($p < 0.05$, Bonferroni-corrected) of the measurement points for fNCI were overlaid on the isopotential map for SEP using high-resolution (2.5-mm inter-electrode distance) recording (Fig. 4). The optimal peak delay for each individual was applied to calculate t-values. The channels with significant t-values and the areas with large SEP isopotential were similarly located.

Locations of the active points of SEP and fNCI for each stimulation point were further assessed quantitatively. Spatial arrangements for each individual are indicated in Fig. 5. The stimulation points at the top (a), middle (b) and bottom (c) parts of the nostril, led to SEP and fNCI active points in the caudal, middle and rostral parts of rostral region, respectively. The distance between the active SEP and fNCI points for the same stimulation point (inter-modal displacement) was 2.7 ± 1.6 mm (mean $\pm$ SD). On the other hand, the distances of the active points between neighboring stimulation points for the same modality (intra-modal neighboring displacement; i.e., top-middle SEP, middle-bottom SEP, top-middle fNCI, middle-bottom fNCI) were 6.1 ± 0.7 mm and 6.8 ± 0.9 mm for fNCI and SEP recordings, respectively. Inter-modal displacement was significantly smaller than intra-modal neighboring displacement ($t = 4.9$, $p < 0.001$ for fNCI and $t = 5.7$, $p < 0.001$ for SEP).

Discussion

In this study, we demonstrated the first direct functional measurement of temporal and spatial patterns of cortical hemodynamics using a newly developed functional near-infrared cortical imaging (fNCI) technique. fNCI successfully detected the somatotopy of pig nostril sensation in the rostral region of the pig lateral cortices, as assessed in comparison with SEP measurements for the same stimulation sites. The illuminator and detecting probes, densely arranged at 5-mm separation, led to as fine a cortical functional map as that of SEP, which cannot be achieved in authentic transcranial measurements where probes are placed on the scalp.

The topographic organization of the S1 region for nose sensation of domestic piglets has been reported for SEP (Craner and Ray, 1991). In the current study, a functional map based on SEP active points reproduced a topographic pattern comparable to the previous report: stimulation to top, middle and bottom parts of the pig nostril led to activation shift from caudal to rostral regions.

This gradual activation shift was also observed in the fNCI measurement using the oxy-Hb parameter. The good agreement between fNCI oxy-Hb and SEP functional maps provides experimental evidence for the feasibility of direct cortical hemodynamic mapping using fNCI. The illuminating and detecting probes were alternately placed 5 mm apart, and the mid-point of each illuminating and detecting probe served as a channel to represent underlying cortical activation. This leads to a distance between neighboring channels of 3.5 mm. This fNCI channel setting yielded a cortical functional activation map with a clear separation between the activation foci: while the intra-modal

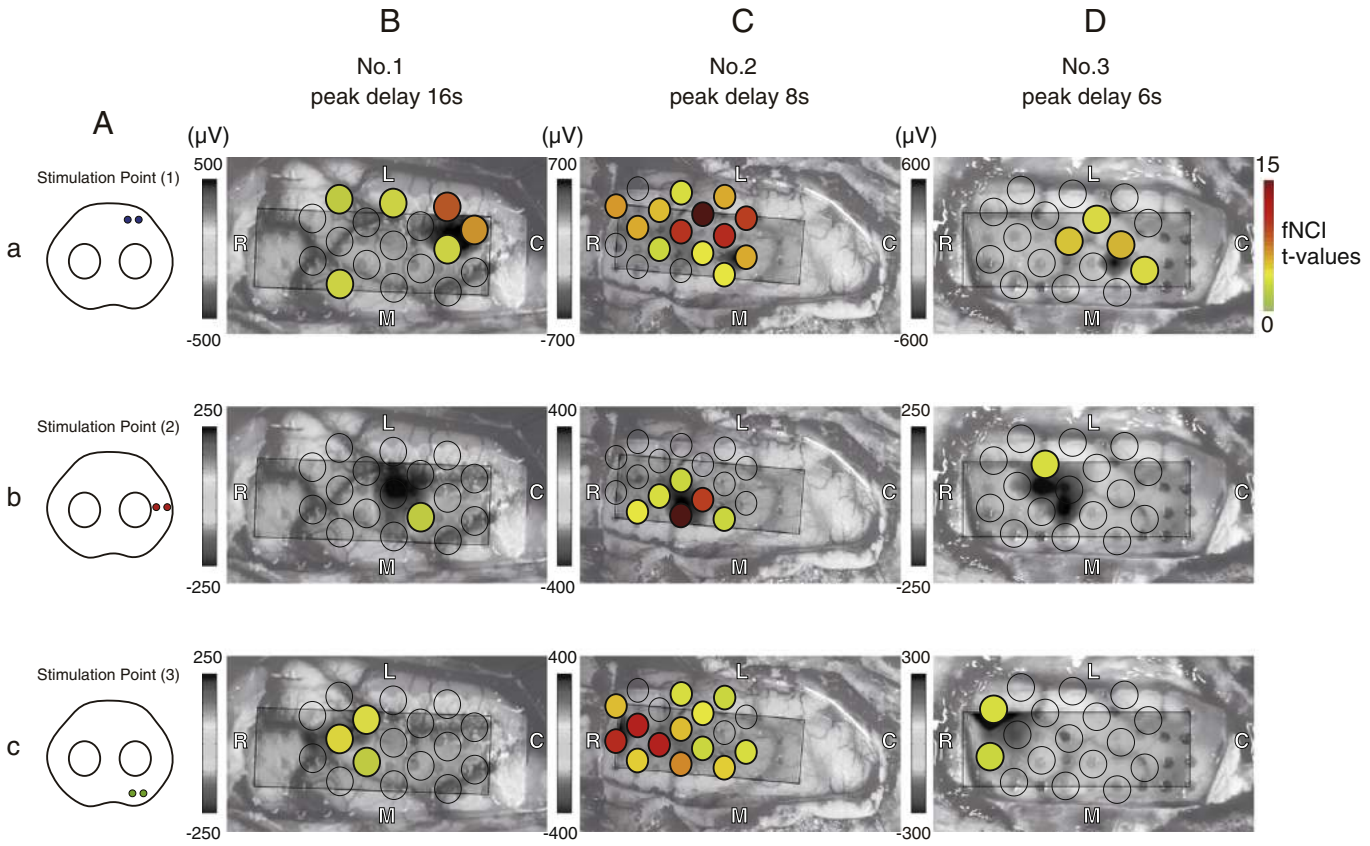

Fig. 4. Isopotential map of SEP and t-values of the significant measured points for fNCI. Column A: position of the stimulation point. Columns B, C, and D: isopotential map of SEP and colored t-values of the measured points for fNCI for one individual pig. Rows a, b, and c show data at top, middle and bottom stimulation points, respectively. The gray scale for each SEP isopotential map is shown at the left side of the image, and the color scale for the fNCI t-values is shown at the right side of the image. The stimulation current intensity was 10 mA at SEP high-resolution recording and 15 mA at fNCI recording.

neighboring displacement for the activation foci of SEP and fNCI was more than 6 mm, the inter-modal displacement for the same activation foci measured by fNCI and SEP was 2.7 mm. This value is also smaller than the inter-channel distance of fNCI measurements. Thus, we concluded that somatotopic cortical representation of the pig nostril sensation from top, middle and bottom regions could be resolved using fNCI.

Although the inter-optode distance of 5 mm resulted in sufficient separation, this value was chosen as a technical characteristic of the experimental apparatus. This value is smaller than the typical inter-optode distance on the scalp of several centimeters. Since fNCI measurement is not impeded by the presence of the scalp tissues, the inter-optode distance might be further reduced to yield better spatial resolution. The optimization of the inter-optode distance for the fNCI method would be an important future topic to explore.

In typical fMRI studies, peak delay is usually fixed to 6 s. However in this study the optimal peak delay differed for each individual (6–16 s). Since the depth of anesthesia is considered to influence peak delay substantially, it is necessary to verify the optimal peak delay for fNCI measurements under anesthesia. Moreover, further investigation is needed into the difference in peak delay among species.

In the current study, we reported the first experimental evidence of functional hemodynamic measurement using near-infrared light directly from the cortical surface. Although common sense led us to imagine that fNIRS with a shorter inter-optode distance would be sufficient to realize direct cortical hemodynamic measurement, this was not so. After repeated experimental failures, we came to understand that the failure could be predominantly attributed to the 'shortcut' taken by light from an illuminator to a neighboring detector.

Thus, we devised an optode holder made of a light-shielding black rubber sheet that could block light leakage from the illuminator. The tip of the illuminator was tightly fit into a hole in the rubber sheet and surrounded by an O-ring-shaped ridge. This prevented light leakage from the side of the illuminator. In the rubber sheet, there were pinholes below each optode position from which near-infrared light emitted from the illuminators could reach the cortical tissue directly. Also, the dispersed and reflected light from the cortical tissue could go directly through the hole to the detector. In addition, the rubber sheet had moderate elasticity so that it could fit to the curved lateral cortical surface of the pig brain without causing any damage to the cortical tissue. One issue which needs to be considered during direct measurement is the influence of physical pressure by the measuring device placed on the brain surface. There are some reports about the possibility that the physical pressure changes the intracellular potential or the electrical activity of the neurons (Andersen et al., 2009; Bistolfi, 2006; Mueller and Tyler, 2013; Petrov, 2006). However, for the current measurements, we took steps to circumvent or reduce the influence of physical pressure. First, measurements were taken after a craniectomy. With a craniectomy, the brain pressure is expected to be lower compared to the intact condition with the presence of the skull and dura mater. In addition, we controlled the position of the optode holder using a precise manipulator, and the use of a rubber sheet helped distribute the pressure uniformly. Secondly, both SEP-only and SEP-fNCI simultaneous measurements resulted in similar SEP patterns (Supplementary Fig. 1). Although the effects of pressure on cerebral blood flow and nerve activity still needs to be examined, at a minimum, the current system was considered sufficiently robust to allow the somatotopy of the pig nostril to be represented in both SEP and fNCI measurements.

The pinholes in the rubber sheet could also be used to control the amount of light passing into cortical tissue. Since a typical fNIRS instrument is adjusted for use on the scalp, the amount of light emitted and

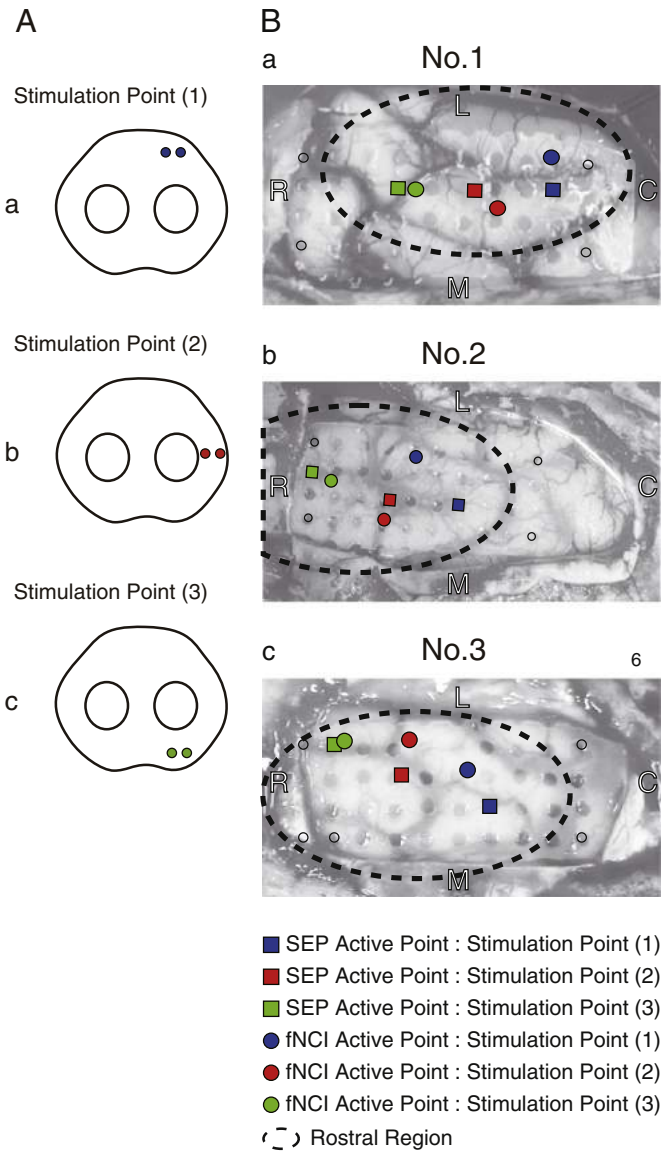

Fig. 5. Active points by stimulation of different points for each animal. The squares indicate SEP active points, and the circles indicate fNCI active points. Filled colors indicate the stimulation points. The rostral regions are indicated with a dashed line.

detected had to be adjusted to avoid both saturation and shortage. The diameter of the optical fiber in the current system was 18 mm. Based on trial and error, we empirically realized that holes with a diameter of 0.5 mm, which reduced the light intensity to 7.7% of the original amount, yielded stable measurements without saturation or shortage of light. Such modification further enabled us to reduce the inter-optode distance to 5 mm. This is far shorter than the typical inter-optode length of more than 25 mm in fNIRS measurement.

For fNIRS measurements on the scalp, several optode arrangements, with increased densities, have been proposed to improve special resolution. For example, two sets of optode holders were alternatively placed to realize a double density measurement (Kawaguchi et al., 2007; Yamamoto et al., 2002). Alternatively, overlapping probes with multiple inter-optode distances enabled image reconstruction to yield higher resolution in a technique called diffuse optical imaging (DOI) or diffuse optical tomography (DOT) (Eggebrecht et al., 2012; White and Culver, 2010; Zeff et al., 2007). High density DOT measurements validated by sequential fMRI measurements yielded an effective spatial resolution of 20 mm (Eggebrecht et al., 2012). Nevertheless, because fNIRS probes must be placed on the scalp, the inter-optode distance itself cannot be reduced: the light source and the detector need to be separated by 25 mm or more in order for light to reach the gray matter under the CSF layer (Germon et al., 1999; Okada et al., 1997).

On the other hand, in fNCI measurements performed directly on the cortex, there is no influence of the skin and skull, and minimum influence of CSF. Therefore, inter-optode distance could be physically shortened. We set the inter-optode length to 5 mm, and twelve optodes could be arranged in the measurement area of 2 by 3 cm, which covered the rostral region. We measured cortical activation from 17 channels in this area and made optical topographic images reflecting cortical activation patterns, from which we demonstrated that activation foci corresponding to cortical representations of the sensations from three parts (top, middle and bottom) of the pig nostril could be resolved. This shows that fNCI could increase the spatial resolution of optical imaging by reducing the inter-optode distance. It should be noted that fNCI and DOT image reconstruction are not exclusive of each other. Hence, if the fNCI technique were coupled with DOT, the spatial resolution could be increased, possibly to the sub-millimeter order, in the future.

In conclusion, the fNCI system realized a direct cortical hemodynamic measurement with a spatial resolution comparable to that of SEP mapping on the rostral region of the pig brain. This study would expand the frontier of fNIRS application from the scalp to the cortical surface. Although the current system has been validated on the pig brain, further investigation could lead to direct cortical monitoring of human brain function, ultimately enabling its application for functional monitoring during neurosurgery of human brains.

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.neuroimage.2013.12.062.

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Salafi Tafsirs: Textualist and Authoritarian?

Izza Rohman[1]

Absract

This essay looks at some Salafi tafsirs to examine the extent to which their interpretation ignores or rejects both the socio-historical context of revelation and that of interpretation, and the extent to which their interpretation denies any possibility to understand the text differently. Taking the ḥijāb verses as a case study, the author shows similarities and differences between the three tafsirs under scrutiny in terms of their "textualism" and "authoritarianism".

Keywords: Salafi tafsir, textualism, authoritarianism, women's issues.

Introduction

In his works, Khaled Abou El Fadl has many times characterized contemporary Wahhabi-Salafis' reading of Islamic (legal) texts as "authoritarian" and "ahistorical" (as well as other attributes he also mentions).[2] His criticism, however, is based on a thorough analysis of the fatwas—many of which are related to the issue of women in Islam—issued by organizations and scholars representing the group—whose discourse to Abou El Fadl has been to a large extent prevalent in many contemporary Muslim societies, even among Muslims in America. The fatwas he examines themselves are far more often based on a certain understanding of hadith, rather than on a particular

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[2] See his books, *Speaking in God's Name: Islamic Law, Authority and Women* (Oxford: Oneworld, 2001) and *And God Knows the Soldier: The Authoritative and Authoritarian in Islamic Discourse* (Maryland: University Press of America, 2001). He defines "authoritarianism" as "the act of 'locking' or captivating the Will of Divine or the will of the text into a specific determination, and then presenting this determination as inevitable, final and conclusive," (*Speaking in God's Name*, 93) or "a hermeneutical methodology that usurps and subjugates the mechanisms of producing meaning from a text to highly subjective and selective reading." (*Speaking in God's Name*, 5). Basically it is an act of closing an open text (the Qur'an), of presenting the text as having a single meaning.

interpretation of the Qur'an. Can thus Abou El Fadl's thesis be applied to Salafis' Qur'anic exegeses? Is an authoritarian and ahistorical kind of interpretation also reflected in their tafsirs?

With regard to Salafis' Qur'anic interpretation in particular, some scholars have come to similar conclusions but in varied terms. Abdullah Saeed has in a few words categorized them as clearly part of "textualism" or "literalism".[3] Following Saeed, but with a broader case of interpretation of Islamic texts, Adis Dudireja concluded that their *manhaj* (method) is "literalist" or at best "semi-contextualist".[4] Similarly, Quintan Wiktorowicz, a political analyst specializing in Wahhabism, characterizes Salafis' approach to the Qur'an as heavily reflecting an "opposition to rationalism"—demonstrated for instance in their interpretation of *āyāt al-ṣifāt* (verses on God's attributes) and *tawḥīd*-related verses.[5] However, while they commonly identify the Salafis as Wahhabis, none of these scholars have analyzed their approach to the Qur'an through a close look at (modern) Salafi tafsirs—which are absent in their bibliographies. To what extent then can Salafi tafsirs be categorized "textualist" or "literalist" and "opposing rationalism"?

This paper seeks to look at Salafis' (i.e. Wahhabis')[6] reading of Islamic

[3]See Abdullah Saeed *Interpreting the Qur'an: Towards a Contemporary Approach* (London & New York: Routledge, 2006), 3. He identifies three broad approaches in relation to Qur'anic interpretation (particularly its ethico-legal content) in the modern world: textualist, semi-textualist and contextualist. In this regard he defines "textualism" as "interpretation that relies on text and tradition *and* at the same time approaches the question of interpretation strictly from a linguistic perspective," and "that ignores or rejects the socio-historical context of the Qur'an in interpretation." (*Interpreting the Qur'an*, 50).

[4]See Adis Dudireja, *Constructing a Religiously Ideal "Believer" and "Woman" in Islam: Neo-traditional Salafi and Progressive Muslims' Methods of Interpretation* (New York: Palgrave Macmillan, 2011), 191-192.

[5]Quintan Wiktorowicz, "Anatomy of the Salafi Movement", *Studies in Conflict & Terrorism* 29 (2006), 207-239.

[6]While the term "Salafi" is not only used in variant meanings by scholars but also contested among those who call themselves Salafis, here the term would be used only to mean the Wahhabis (a term commonly used by non-Salafis or non-Wahhabis but they themselves rarely do so and mostly dislike to do so), particularly the "purists" (who does not form or involve in any local or transnational political movement). The word "salafī" is derived from the word "salaf" which means "predecessor". The term "*al-salaf*" is mostly used to denote the first Muslim generation (until the period of *tābi'ūn* or *tābi' al-tābi'īn*), and is often affixed by the word *ṣāliḥ*; *al-salaf al-ṣāliḥ,* which literally means the "righteous predecessors". The term "Salafi" or "Salafiya" therefore means those who follow the path of *al-salaf al-ṣāliḥ* as model examples. The term "Salafi" is often used by contemporary scholars to only mean the Wahhabis [see for instance Wiktorowicz, "Anatomy of the Salafi Movement"; Saeed, *Interpreting the Qur'an*; and Dudireja, *Constructing a Religiously Ideal "Believer" and "Woman" in Islam*], but is also equally

texts through their Qur'anic exegeses written by three scholars from rather different generations—two of whom surely lived decades earlier than the Salafis to whom Abou El Fadl addresses his critiques. The three Salafi tafsirs involved here are: 1) *Taysīr al-Karīm al-Raḥmān* by 'Abd al-Raḥmān ibn Nāṣir al-Sa'dī (1889-1956),[7] 2) *Aḍwā' al-Bayān* by Muḥammad al-Amīn al-Shinqīṭī (1907-1973),[8] and 3) *Aysar al-Tafāsīr* by Abū Bakr Jābir al-Jazā'irī (1921-).[9] These three tafsirs are arguably the most popular tafsirs written by (modern)

often used to include the Wahhabis and other variants of Salafism [see for instance Abou El Fadl, *And God Knows the Soldier* and *Speaking in God's Name*], and is sometimes used to refer to non-Wahhabi Salafism, either the modernists [see for instance Abou El Fadl, *The Great Theft: Wrestling Islam from the Extremists* (San Francisco: HarperCollins, 2007) and Massimo Campanini, *The Qur'an: The Basics*, translated by Oliver Leaman (London & New York: Routledge, 2007)] or to a much lesser extent the Ikhwanis or similar Islamists. It is important to note that one should not be confused by the term "Salafi" (or "Salafism") in its contemporary usage and the term "Salafiya" (sometimes simply "Salafi" or "Salafism") which is sometimes still used to refer to the earlier movement of the Muslim modernists like Jamal al-Din al-Afghani, Muhammad 'Abduh and Muhammad Rashid Rida. For a brief history (and anatomy) of Wahhabism, see for instance Abou El Fadl, *The Great Theft*, 45-94; and Wiktorowicz, "Anatomy of the Salafi Movement".

[7]Al-Sa'dī was the only Salafi exegete of Saudi origin among the three scholars discussed here. He was born and buried in 'Unayzah in the Qasim Province of Saudi Arabia. He was among the influential teachers of Muḥammad ibn Ṣāliḥ al-'Uthaymin (1925-2001), one of the most influential Salafi scholars who reportedly delivered lectures in the Masjid al-Haram, Mecca, for over thirty five years. *Taysīr al-Karīm al-Raḥmān* is said to be the most famous among not less than a dozen of his works. For his brief biography, see his tafsir, *Taysīr al-Karīm al-Raḥmān fī Tafsīr Kalām al-Mannān* (Cairo: Dār al-Ḥadīth, 2005), 11-13.

[8]Al-Shinqiti (not to be confused by another al-Shinqīṭī who was the teacher of al-Sa'dī or other equally prominent scholars named al-Shinqīṭī) was a Mauritanian scholar but later resided in Saudi after performing *ḥajj* in 1367 AH. He reportedly completed teaching tafsir in Masjid al-Nabawi twice. Initially a follower of Maliki madhhab, he was the teacher of some of the most influential Salafi figures like the former mufti of Saudi, 'Abd al-'Azīz Bin Bāz (1909-1999), and a radical figure, Ḥammūd al-'Uqlā al-Shu'aybī (1925-2002)—who was also said to be one of Abū Bakr al-Jazā'irī's teacher. See for instance Wiktorowicz, "Anatomy of the Salafi Movement", 236. In *Aḍwā' al-Bayān*, his masterpiece, al-Shinqīṭī himself does not interpret the whole of the Qur'an, but he finishes at al-Mujādalah [58]: 22. The rest included in the last two volumes was done by his disciple, 'Atiyah Muhammad Salim, with Bin Bāz's encouragement. For al-Shinqīṭī's short biography, see his tafsir, *Aḍwā' al-Bayān fī Īḍāḥ al-Qur'ān bi al-Qur'ān* (Beirut: Dār Iḥyā' al-Turāth al-'Arabī, n.d.), vol. 1, 9-26.

[9]Al-Jazā'irī was an Algerian scholar who later resided in Saudi. A prolific scholar, al-Jaza'iri was initially well-known for his *Minhāj al-Muslim*, which has been translated into many languages—Urdu, French and Indonesian among others. *Aysar al-Tafāsīr* is among his latest works and the most voluminous.

Salafi scholars.[10] Their popularity among Salafis themselves is perhaps only exceeded by such tradition-based tafsirs as *Tafsīr al-Qur'ān al-'Aẓīm* by Ibn Kathīr (which follows the principles and methods of tafsir outlined by his teacher, Ibn Taymīyah, a figure labeled as a "salafi par excellence")[11] and *Jāmi' al-Bayān* by Ibn Jarīr al-Ṭabarī (a tafsir Ibn Taymīyah recommends most).[12]

In addition to revealing some of the characteristics of Salafis' approach to the Qur'an embodied in these three tafsirs, I will—for the purpose of this study—take the case of the interpretation of Qur'anic ethico-legal verses related to women's issues, particularly two interrelated issues of the rule of gazing at "unrelated" women (*al-naẓar ilā al-ajnabīyah*) and the segregation (*'adam al-ikhtilāṭ*) between male adults and female adults. The choice to limit this to women's issues is partly because the so-called Wahhabis has often been regarded as imposing harsh restrictions on women, and also because Abou El Fadl and Dudireja have come to the conclusion this study wants to verify, that the Salafi/Wahhabi approach is largely "authoritarian" and "literalist/textualist", mainly based on an examination of the fatwas or Salafi scholars' views regarding women's issues. My choice to focus on the issues of gazing at the *ajnabīyah* and gender segregation is primarily due to the fact that these are among a number of issues where strict rules on them are very often ascribed to Salafis—though some of the traditionalists, another group which is also considered a proponent of textualism, might also advocate similarly rigid stances. While so-called traditionalists are considered to deal with the issues in a less rigid manner, Salafis—who are initially more distinctive in terms of their *'aqīdah* rather than in terms of their *fiqh*—are repeatedly said to insist on strict rulings on (seeing) women's *'awrah* (part of their body which should be covered which, according to Salafis, happens to be their whole body except for the eyes or even one of the eyes) and strict male-female segregation.[13]

Their standpoints on both issues are often justified by a certain

[10]There is another contemporary Salafi tafsir written by a popular figure, 'Ā'iḍ al-Qarnī entitled, *al-Tafsīr al-Muyassar* (Riyad: al-'Ubaykan, 2007) but this tafsir is too concise to be included in my analysis.

[11]See Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm* (Mu'assasah Qurṭūbah, n.d.), 6-19.

[12]See Ibn Taymīyah, *Muqaddimah fī Uṣūl al-Tafsīr* (Beirut: Dār Ibn Ḥazm, 1997), 110.

[13]This assumption seemingly needs further clarification since strict gender segregation and rigid rules on female *'awrah* might extend Salafi and non-Salafi boundaries. See its indication for instance in Muḥammad 'Alī al-Ṣābūnī, *Tafsīr Āyāt al-Aḥkām min al-Qur'ān* (Beirut: Dār al-Kutub al-'Ilmīyah, 1999), vol. 2, 109-112, 254. However, here it suffices to say that Salafis are among renowned advocates of strict legal rulings on these matters.

understanding of the "*āyāt al-ḥijāb wa al-naẓar*" (verses on partition and gazing), i.e. al-Nūr [24]: 30-31 and al-Aḥzāb [33]: 53 (sometimes also 59). Therefore, here I will focus (though not exclusively) on how these verses are interpreted in the three tafsirs under scrutiny. In analyzing their interpretation, I will mainly employ two criteria derived respectively from Saeed's definition of textualism and Abou El Fadl's definition of authoritarianism,[14] namely: 1) the extent to which an interpretation ignores or rejects both the socio-historical context of revelation and that of interpretation, and 2) the extent to which an interpretation "closes the open text", meaning that it denies any possibility to understand the text differently and implies that the text means only "Y" though it has been understood by others to mean "X" or "Z". This in some way means that here I will chiefly focus on the Salafi exegetes' treatment of the "textuality" of the Qur'an and their treatment of differences in interpretation.

By doing so, I am at risk of merely imposing an outsiders' perspective on Salafi tafsirs. Therefore, in an effort to be more balanced, I will seek to address the problem of ignorance/attentiveness of the context of the Qur'an and the problem of authoritarian/authoritative interpretation through what I consider as their relevant principles of interpretation so as to understand a certain way of thinking which might lie behind their textual/contextual and authoritarian/authoritative approach to the Qur'an. Accordingly, before discussing their interpretation on "*ḥijāb* verses", a methodological review of the three tafsirs will be outlined below to shed light on the nature of Salafi hermeneutics, particularly in connection with Salafis' views on the "context" of the Qur'an and the "plurality of interpretation".

Taysīr al-Karīm al-Raḥmān, *Aḍwā' al-Bayān*, *Aysar al-Tafāsīr* and Salafi Approaches to the Qur'an

It might have been often assumed that Salafis generally give preferentiality to the style of what so-called *tafsīr bi al-ma'thūr/tafsīr bi al-riwāyah* ("tradition-based Qur'an exegesis")—mainly because it is presumably far from innovations (*bida'*), rather than that of *tafsīr bi al-ra'y/tafsīr bi al-dirāyah* ("reason based Qur'an exegesis"). However, this assumption seems to be not totally correct. Among the three Salafi tafsirs, only *Aḍwā' al-Bayān*, a six-volume tafsir,[15] can be undoubtedly classified a *tafsīr bi al-ma'thūr*, especially one that generally follows the steps recommended by Ibn Taymīyah

[14]See the definitions in footnote 1 and 2.

[15]It is the edition printed by Dār Iḥyā' al-Turāth al-'Arabī, Beirut. *Aḍwā'* was previously printed in nine volumes by Dār 'Ālam al-Fawā'id, Mecca.

and Ibn Kathīr.[16] Quite the opposite, *Taysīr al-Karīm al-Raḥmān*, a one thousand and more-page tafsir,[17] and *Aysar al-Tafāsīr*, a six-volume tafsir, are more similar to *tafsīr bi al-ra'y* in style, the former being comparable to *Tafsīr al-Jalālayn* by Jalāl al-Dīn al-Maḥallī and Jalāl al-Dīn al-Suyūṭī as well as two much shorter contemporary tafsirs, *al-Tafsīr al-Wajīz* by Wahbah al-Zuḥaylī and *al-Tafsīr al-Muyassar* by another Salafi author 'Ā'iḍ al-Qarnī, while the latter being to some extent comparable to *Tafsīr al-Marāghī* by Aḥmad Muṣṭafā al-Marāghī but shorter. Of course, Salafis are among Muslims who strongly insist on the need to avoid *ra'y* (baseless personal opinion) in interpreting the Qur'an, and even consider tafsir with pure *ra'y* illegitimate, but if one defines *tafsīr bi al-ra'y* as the one that does not display *riwāyāt* (narrations) in the interpretation, then both *Taysīr* and *Aysar* can be categorized so. Nonetheless, it is inaccurate to say that al-Sa'dī and al-Jazā'irī very much employ rational thinking in interpreting the Qur'an.

While al-Sa'dī's *Taysīr* is best described as a *tafsīr ijmālī* ("concise sequential commentary")[18] and al-Shinqīṭī's *Aḍwā'* is clearly a *tafsīr taḥlīlī* ("analytical sequential tafsir"), al-Jazā'irī's *Aysar* is somewhere in between. Therefore, *Taysīr* and *Aysar* to a lesser extent, seem to reflect more a premise Salafis hold that the messages of the Qur'an are clear enough, and that understanding the Qur'an is not really a complicated problem—which for one thing implies that there is no need for long-winded interpretation (*iṭnāb* or *taṭwīl*). Both tafsirs represent a broader modern trend of providing a "made-easy" and "made-simple" (*sahl muyassar*) tafsir.[19] This "selling-point" is implied in the titles of both and clearly stated in the introductions to each.[20] Given the way Salafis see the clarity of Qur'anic messages, some scholars like Wiktorowicz have even suggested that for Salafis, "there is really no such thing

[16]That is to find explanation (tafsir) firstly from the Qur'an, then from hadith, and then from the opinions of the companions of the Prophet and then from the opinions of the successors (*tābi'un*). See Ibn Taymīyah, *Muqaddimah fī Uṣūl al-Tafsīr*, 84-109, his *al-Tafsīr al-Kabīr* (Beirut: Dār al-Kutub al-'Ilmīyah, n.d.), vol. 2, 231-244, and Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm*, 6-19.

[17]It is reported (in the introduction to the book) that it was once printed in five volumes.

[18]See for instance Fahd ibn 'Abd al-Raḥmān al-Rūmī, *Buḥūth fī Uṣūl al-Tafsīr wa Manāhijihi* (Maktabat al-Tawbah, n.d.), 59-60.

[19]Other tafsirs within this trend include al-Qarnī's *al-Tafsīr al-Muyassar*, al-Zuḥaylī's *al-Tafsīr al-Wajīz* and 'Alī al-Ṣābūnī's *Ṣafwat al-Tafāsīr*.

[20]See introductions to *Taysīr* by 'Abd Allāh ibn 'Abd al-'Azīz ibn 'Aqīl and Muḥammad al-Ṣāliḥ al-'Uthaymin in *Taysīr*, 5-7; and al-Jazā'irī's introduction to his *Aysar al-Tafāsīr li Kalām al-'Alīy al-Kabīr* (Medina: Maktabat al-'Ulūm wa al-Ḥikam, 2003), vol. 1, 4-6.

as interpretation".[21]

On the other hand, *Aḍwā'* is more similar to many of the voluminous classical tafsirs in which extended discussions on certain topics—as well as quotations of *sha'ā'ir* or *shawāhid 'arābīyah* (Arabic poems)—might sometimes interrupt the author's interpretation. Nevertheless, among the three, *Aḍwā'* is perhaps the best example of a Salafi tafsir built on the premise that the Qur'an is self-explanatory—a premise that Salafis also strongly hold. While it largely follows the tradition of interpretive methodology endorsed by Ibn Taymiyah, *Aḍwā'* is quite different from the tafsirs of Ibn Kathīr or Ibn Qayyim (two prominent disciples of Ibn Taymīyah) in that it is mostly based on an intensive application of the methodology of interpreting the Qur'an by the Qur'an itself, rather than heavily relying on hadith like Ibn Kathīr's tafsir. *Aḍwā'* is even arguably one of the most intensive tafsirs in terms of the application of cross-referential hermeneutics.[22]

The three Salafi authors, however, unanimously follow the spirit of Ibn Taymīyah's "anti-*ta'wīl*" when dealing with "ambiguous verses" (*āyāt mutashābihāt*).[23] Al-Jazā'irī states in his introduction to his tafsir that it follows *manhaj al-salaf* when interpreting verses related to *'aqīdah* and *asmā' wa al-ṣifāt*.[24] Muḥammad al-'Uthaymin says the same with regard to al-Sa'dī's tafsir.[25] Al-Shinqīṭī himself wrote a book arguing against the existence of *majāz* ("allegorical/metaphorical" expressions) in the Qur'an, *Man' Jawāz al-Majāz fī al-Munazzal li al-Ta'abbud wa al-I'jāz*, which is attached in the last volume of *Aḍwā'*.[26] This "anti-*ta'wīl*" attitude is reflected for instance in their interpretation (or rather: lack of interpretation) of *al-ḥurūf al-muqaṭṭa'ah*

[21]Wiktorowicz, "Anatomy", 210. For a comparable statement see Dudireja, *Constructing a Religiously Ideal*, 191.

[22]My preliminary research comparing his tafsirs with other tafsirs known for their serious attention to *tafsīr al-Qur'ān bi al-Qur'ān* reveal that *Aḍwā'* is the most focused in citing relevant verses in other parts of the Qur'an while interpreting a certain word, verse or group of verses. Taking the case of suras al-Fātiḥah and Qāf as samples, *Aḍwā'* cites on average 8.9 times on each page, while al-Rāzī's *Mafātīḥ al-Ghayb* cites 3.4 times/page, al-Qāsimī's *Maḥāsin al-Ta'wīl* cites 1.8 times/page, Ibn Kathīr's *Tafsīr al-Qur'ān al-'Aẓīm* cites 1.7 times/page, and al-Ṭabāṭabā'ī's *al-Mīzān* cites 1.3 times/page.

[23]For the discussions on how al-Sa'dī and al-Shinqīṭī interpret *āyāt al-ṣifāt*, read Muḥammad ibn 'Abd al-Raḥmān al-Mighrāwī, *al-Mufassirūn bayna al-Ta'wīl wa al-Ithbāt fī Āyāt al-Ṣifāt* (Beirut: Mu'assasat al-Risālah, 2000), 694-705.

[24]Al-Jazā'irī, *Aysar al-Tafāsīr*, vol. 1, 6.

[25]Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 7.

[26]See al-Shinqīṭī, *Aḍwā' al-Bayān*, vol 6, 389-410. The belief whether or not *majāz* exists in the Qur'an surely affect the way exegetes interpret *ṣifāt*-related verses.

(initial letters in the beginning of suras).[27]

While for Salafis following the *manhaj* is of utmost importance to avoiding any misunderstanding of what God means, for critics it would mean a blunt opposition to rationalism. They have argued that Salafis adhere to the text to a point where they consider the application of human intellect and logic (rationalism) to the Qur'an to be dangerous. "Any time humans attempt to apply their own logic or methods of reasoning … they open the way to human desire, distortion, and deviancy. Approaches that are guided by human logic will necessarily fall foul of human desire, which will lead to the selective and biased extrapolation of religious evidence to support human interests rather than religious truth."[28]

In addition to their similarities in their treatment of *'aqīdah* verses, to a certain degree the three tafsirs are equally concerned with *aḥkām* verses. Al-Shinqīṭī himself states that one of his objectives in *Aḍwā'* is to provide explanations of *āyāt al-aḥkām* in the Qur'an. A close look at *Taysīr* and *Aysar* will reveal a similar conclusion. With regard to *Aysar*, it is understandable that one of al-Jazā'irī's aims is for the readers to focus more on how to implement the Qur'an.[29]

Nevertheless, when addressing differences of opinion/interpretation, the three tafsirs have different attitudes. While *Aysar* and *Taysīr* consciously avoid mentioning *ikhtilāf* among exegetes, *Aḍwā'* frequently mentions different opinions, particularly with regard to *āyāt al-aḥkām*—though the author seems to always mention what he regards as the strongest of opinions. For the authors of *Aysar* and *Taysīr*, the intentional avoidance of mentioning differences in

[27]Al-Sa'dī simply mentions that the safest is "*al-sukūt*" (silencing) what it might mean and be sure that there exists a *ḥikmah* (wisdom) we do not know, or simply mentions that no one knows its meaning except for Allah, or simply makes no comments on those letters. Similarly, al-Jazā'irī simply suggests that such letters are a part of *mutashābih* of which only God who knows its meaning, or simply mentions that the *salaf's* school regarding such letters is to say, "God knows its intended meaning." In the case of *ṭāhā* (Ṭāhā [20]: 1), however, al-Jazā'irī—following al-Ṭabarī—says that it means "O man", an opinion that is disapproved by al-Shinqīṭī. Al-Shinqīṭī himself rarely gives any comment on those letters, but explains his preference while interpreting Hūd [11]: 1. Implementing the method of *istiqrā' al-Qur'ān*, he follows the conclusion of al-Rāzī, Ibn Kathīr and Ibn Qayyim al-Jawzīyah that such letters are an indication that the subsequent discussion in a sura, where those letters are mentioned, deals with the inimitability (*i'jāz*) of the Qur'an. See al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 2, 5-7. The function of these letters as a sign of *i'jāz* has been discussed in more detail by 'Ā'isha Bint al-Shāti' in her *al-I'jāz al-Bayānī li al-Qur'ān* and *al-Tafsīr al-Bayānī li al-Qur'ān al-Karīm*.

[28]Wiktorowicz, "Anatomy", 210.

[29]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6.

interpretation (*ighfāl al-khilāfāt al-tafsīrīyah* in al-Jazā'irī's term or *tajannub dhikr al-khilāf* in al-'Uthaymin's word while introducing al-Sa'dī's tafsir) is another "selling-point" of both tafsirs, and seems to have something to do with the perceived need for "uniting Muslims in a unified, correct and good Islamic thinking" (*jam' al-muslimīn 'alā fikr islāmī muwaḥḥid ṣā'ib salīm*).[30] For Salafis, what is considered "correct" when looking at differences of interpretation is usually the one that is exemplified by exegetes among the Companions or the Successors—whom they call *jumhūr al-mufassirīn min al-salaf al-ṣāliḥ*. In the case of al-Jazā'irī, the "selected" opinion from existing different interpretations is usually, as he himself states, relied upon al-Ṭabarī's preference.[31]

It might often be argued that in terms of the truth one can achieve through interpretation, Salafis view that there is an objective meaning that we can take hold of, and there is only one legitimate religious interpretation. It has also been argued that for Salafis Islamic pluralism does not exist, and if it seems exist, it should be avoided.[32] In critics' words, Salafis approach the authoritative text to a point that they identify with and represent the text or the singular truth revealed by the text; they consider their understanding as the only "correct" one and reject any possible meaning other than their understanding. However, if one looks at al-Shinqīṭī's tafsir in particular, this perceived single legitimate, objective interpretation is achieved in a more argumentative manner. Al-Shinqīṭī heavily relies on what the Qur'an tells in other verses to determine what is intended by a certain word or phrase in a particular verse. His manner of interpretation is perhaps more "textualist" but less "authoritarian". Meanwhile in the case of al-Jazā'irī's tafsir, this "single legitimate" is achieved through reliance on a selected "authoritative" *salaf*. In the name of practicality and the unity of *umma*, he transforms what the critics would consider as an "un-authoritarian" way of interpretation into what they would consider as an "authoritarian" way of interpretation, a negligence of multiple understandings and the complexity of meaning. If his interpretation is to be considered "authoritarian", one can now learn how such an "authoritarian" reading is constructed through not only a historical leap, but also a selective manner—limiting to one among different *salaf*'s interpretations—which they regard mainly contain *ikhtilāf tanawwu'* (corresponding difference), and not *ikthilāf*

[30]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6. Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 7.
[31]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6.
[32]See for instance Wiktorowicz, "Anatomy", 207.

taḍād (contradictory difference).[33]

Hermeneutics in the three tafsirs is largely "text-centered", rather than "reader-centered", and "language-oriented" rather than "discourse-oriented".[34] In their text-centered hermeneutics, remains a very limited attention to the socio-historical context of the Qur'an—as is the case with many tafsirs. Apart from mentioning *asbāb al-nuzūl*, there is hardly any reference both to the past and present contexts. This "textualist" tendency can to some extent be attributed to the principles tafsirs Salafis consider to be important in order not to misunderstand what the Qur'an means. Al-Sa'dī's method of interpretation itself is noticeably based on the principles—many of which deal with deriving "general" Qur'anic rulings with linguistic analysis—outlined by Ibn Qayyim which readers can read in the beginning, and is partly summarized at the end of al-Sa'dī's book.[35] A notable emphasis on the "generality/universality" of the text is also apparent in al-Shinqīṭī's tafsir—and that of al-Jazā'irī as well except that the latter is often satisfied with simply following the conclusion of al-Ṭabarī while al-Shinqīṭī focuses more on the application of his own interpretive methodology.

The Rulings on Gazing at Women and Male-Female Segregation in Salafi Tafsirs

The three tafsirs under discussions by and large come to the same conclusion regarding these two issues: 1) that gazing at any part of the *ajnabīyah's* body is forbidden, and 2) that there should be no free mixing (*ikhtilāṭ*) between male and female. Their argument principally is this: free mixing is prohibited since gazing at a woman (as well as talking to a woman face to face) is prohibited, and gazing at a woman is prohibited since all parts of her body (except for her eyes) are considered *'awrah* (private part/shame of sex) which should remain veiled; and gazing at *'awrah* is prohibited since gazing might results in "dirt heart/a dirty heart", "lust" (*shahwah*) and even "adultery" (*zinā*).[36]

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[33]How Salafis see differences among *salafs* is very much influenced by this distinction made by Ibn Taymīyah between *ikhtilāf tanawwu'* and *ikhtilāf taḍād*. See his *Muqaddimah fī Uṣūl al-Tafsīr*, 36; *Iqtiḍā' al-Ṣirāt al-Mustaqīm Mukhālafat Aṣḥāb al-Jaḥīm* (al-Majd al-Tijārīyah, n.d.), 37-39; and *al-Tafsīr al-Kabīr*, vol. 2, 196.

[34]For this distinction between "language" and "discourse" derived from the linguist and literary theorist Tzvetan Todorov, see Saeed, *Interpreting the Qur'an*, 106-107.

[35]See al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 14-20, 1043-1046.

[36]Both the conclusion and argument are not actually uncommon among Muslim exegetes. See some comparable conclusions and arguments (but sometimes with minor

Even though our focus here is on the way they interpret the *ḥijāb* verses, rather than on the conclusion they make itself, here one would pay attention to their steps to come to the conclusion while interpreting the verses. There are some terms or concepts in al-Nūr [24]: 30-31 and al-Aḥzāb [33]: 53 which are understood as implying that for a male adult (*mumayyiz*), seeing an "unrelated" woman (particularly whose *'awrah* is not totally masked) is forbidden, and that there should be a "veil/curtain" between male and female adults: 1) *ghaḍḍ al-baṣar* (lowering gaze/casting down eyes), 2) *ibdā' al-zīnah* (displaying/showing off adornments), and 3) *(mukhāṭabah) min warā' ḥijāb* (talking from behind a curtain/screen).

As it might be predicted, given their conciseness and tendency to consciously display only one interpretation, even when dealing with differences, *Taysīr* and *Aysar* are more straightforward in highlighting these "clear" instructions in the verses. The author of *Taysīr* understands the first instruction (*ghaḍḍ al-baṣar*) as casting down one's eyes from looking at the *'awrah* and "unrelated" men or women with lust or from similar forbidden looks.[37] He then proceeds with what is meant by *al-zīnah* which for him includes clothes, jewels and all parts of a woman's body, and by the exception in the verse (understood from the phrase *illā mā ẓahara minhā*) which means "their visible clothes". The understanding of *al-zīnah* as including all parts of a woman's body, to al-Sa'dī, is indicated by the sequential instruction of *iḍrāb al-khumūr 'alā al-juyūb* (drawing the veils/headcovers over the bosom). And with regard to talking to a woman *min warā' ḥijāb*, he understands it as implying that looking at a woman is forbidden (*mamnū'*) in any situation (*bi kull ḥāl*). He then explains that the *ḥikmah* of this instruction mentioned in the phrase *dhālikum aṭhar li qulūbikum wa qulūbihinna* (that is purer for your hearts and their hearts) indicates a principle of sharia that *jamī' wasā'il al-sharr wa asbābuhu wa muqadimmātuhu mamnū'ah* (any means, cause and preliminary of wrongdoing is prohibited).

In interpreting these verses, as is the case with the majority of Qur'anic verses, the author of *Taysīr* neither displays any linguistic analysis, mentions any hadith (*riwāyah*) to support his conclusion, quotes any other relevant verses, mentions a principle of *uṣūl al-fiqh* or *uṣūl al-tafsīr*, discusses different socio-cultural contexts, nor mentions any different opinions. This is also the case with the author of *Aysar*—except that he mentions the occasions of

difference in terms of the limits of *'awrah*) in Muḥammad ibn Aḥmad al-Anṣārī al-Qurṭūbī, *al-Jāmi' li Aḥkām al-Qur'ān* (Cairo: Dār al-Ḥadīth, 2002), vol. 6, 513-519; 'Alī al-Ṣābūnī, *Tafsīr Āyāt al-Aḥkām*, vol. 2, 109-115, 254.

[37] Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 615.

revelation (*asbāb nuzūl*) in interpreting 33: 53.[38]

Compared to al-Sa'dī, al-Jazā'irī however at one point has a different understanding of *ibdā' al-zīnah* which means to him revealing parts of a women's body which serve as places of jewelry (*mawāḍi' al-zīnah*), and of the exception, *illā mā ẓahara minhā,* as the one that could not surely be hidden like eyes, palms or clothes. While interpreting the *jilbāb* verse, 33: 59, he goes further to briefly mention that today there is even no need for not covering eyes, since a woman can use a thin layer (*qumāsh raqīq*) to veil her eyes and at the same time can still look at the street she is passing along.[39] In addition, he firmly stresses that 33: 53 in part explains that a man would have a certain degree of "wicked imagination" (*khawāṭir al-sū'*) when talking to and looking at a woman.[40]

On the other hand, the author of *Aḍwā'* does many of the things that the authors of *Taysīr* and *Aysar* do not do. He slightly discusses a linguistic problem by quoting classical exegetes like al-Zamakhsharī and al-Qurṭūbī, as well as quoting some relevant *shi'rs*. He discusses some seemingly contradictory hadiths relevant to understanding of the verses. He mentions many relevant verses useful to better understand the verse under discussion. He mentions some principles of *uṣūl al-tafsīr*. Above all, he mentions different interpretations and subsequently argues against some of the interpretations, but finally declares that *wa Allāh ta'ālā a'lam* (God the Exalted knows best).

While interpreting sura 24: 31,[41] al-Shinqīṭī sums up the different interpretations of *zīnah* into three viewpoints: 1) that it means parts of a woman's body, 2) that it means ornaments/jewels a woman uses for her beauty which do not necessarily require a part of her body to be revealed, 3) that it means ornaments a woman uses for her beauty which necessarily require a part of her body to be revealed.[42]

Al-Shinqīṭī then proceeds with quotations from Ibn Kathīr, al-Qurṭūbī, al-Zamakhsharī and al-Suyūṭī (who mention interpretations of earlier generations) before once again asserting that the differences among *salaf* can be summarized in those three categories, and that for him the second (that *zīnah*

[38]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 287, 291.
[39]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 292.
[40]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 289.
[41]Al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 4, 95-104.
[42]Al-Jazā'irī's position would fit the last, while al-Sa'dī's stance is more a combination between the first and the second. Al-Jazā'irī's position in this case is a bit different from al-Ṭabarī (the exegete he often relies on) who prefer the opinion that the exception of *zīnah* refers to the palms and the face. See Ibn Jarīr al-Ṭabarī, *Jāmi' al-Bayān fī Ta'wīl al-Qur'ān* (Beirut: Dār al-Kutub al-'Ilmīyah, 2005), vol. 9, 306.

means something outside her body [*khilqah*] which does not necessarily require a part of a woman's body be seen) which implies that *mā ẓahara minhā* means her clothes, is the clearest and most careful stand.[43]

Al-Shinqīṭī then mentions some principles of tafsir (he often uses in his tafsir) which support his argument, namely the identification of *qarīnah fī nafs al-āyah* (evidence in the same verse) and the identification of the most usual intended meaning of the word in the Qur'an (*al-murād min al-lafẓ fī al-ghālib*) to see whether an interpretation is appropriate—two principles that he also uses in interpreting the *ḥijāb* verse in al-Aḥzāb. Implementing both principles, al-Shinqīṭī argues that the first opinion is invalid. The choice is thus now only between the second and the third.

Al-Shinqīṭī then uses the principle of "carefulness" (*iḥtiyāṭ*) to weigh the second over the third. The second, he argues, is farther from the *'illah* (underlying reason) of the prohibition of gazing at a woman (i.e. *fitna* and *ṭuhūr al-qalb*) and thereby more preventive from any disallowed occurrence.

Moreover, again arguing against the first and the third opinions, al-Shinqīṭī asserts the poor quality of a hadith indicating that a woman's *'awrah* excludes her face and palm.

While interpreting 33: 53,[44] al-Shinqiti also uses the two abovementioned principles of tafsir to argue against those who consider that the instruction of talking *min warā' ḥijāb* only applies to the Prophet's wives. The reasoning (*ta'līl*) mentioned in the verse (*dhālikum aṭhar liqulūbihim wa qulūbihinna*) is universal/general and thereby the *ḥukm* (ruling) is also universal/general. He argues that this principle, that the generality of *'illah* means the generality of *ḥukm*, is already well-known in *uṣūl al-fiqh*.

Al-Shinqīṭī further supports his argument with other relevant Qur'anic verses (33: 59, 60 and 24: 31). He explains how these verses support his argument and argues against those who interpret these quoted verses differently. He supports the authoritativeness of his interpretation with that of exegetes among the Companions—who relate the verse with its *sabab nuzūl*—as well as linguistic argumentation.

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[43]It should be noted that al-Shinqīṭī's stand on the meaning of *zīnah* is different from that of al-Qurṭūbī (an exegete from whom he quotes some narrations) and earlier narration-minded exegetes like al-Ṭabarī (as mentioned in the previous footnote). His view is also a bit different from, but closer to, that of al-Zamakhsharī. See al-Qurṭūbī, *al-Jāmi' li Aḥkām al-Qur'ān*, vol. 6, 519; Abū al-Qāsim Maḥmūd al-Zamakhsharī, *al-Kashshāf 'an Ḥaqā'iq Ghawāmiḍ al-Tanzīl wa 'Uyūn al-Aqāwīl fī Wujūh al-Ta'wīl* (Riyad: Maktabah al-'Ubaykān, 1998), vol. 4, 289-291.

[44]Al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 4, 287-297.

Again he asserts another similar principle of *uṣūl* which supports the generality of the *ḥijāb* instruction, namely that *khiṭāb al-wāḥid ya'ummu ḥukmuhu jamī' al-ummah, wa lā yakhtaṣṣu al-ḥukm bi dhālika al-mukhāṭab al-wāḥid*, and stresses the soundness of this principle.

He then argues against those who support the specificity of the *ḥijāb* instruction only to the Prophet's wives by employing a logic: if it was only for the Prophet's wives, they surely are good examples (*uswah*) for all Muslim women.[45]

Subsequently al-Shinqīṭī mentions and discusses some hadiths (and quotes their interpretations by Ibn Ḥajar) which support the generality of the instruction as well as supporting the interpretation of *iḍrāb al-khumūr 'alā al-juyūb* as veiling the face. He then feels the need to briefly assert the position of hadith as the *mubayyin* of the Qur'an by quoting a relevant verse. Next he expresses his amazement with those who say that there is neither Qur'anic verse nor hadith which show the obligation for women to veil their face in the presence of "unrelated" men (*ajānib*).

Later al-Shinqīṭī cites some hadiths, stating that a woman is *'awrah,* which support the obligation of *ḥijāb* and discusses some hadiths used by those who argue for the permissibility of women to unveil their face and palms in the presence of the *ajānib.* He shows the poor quality of these hadiths, or otherwise, clarifying that the hadiths seemingly indicating that women did not veil their face during the Prophet's time do not really point out that they unveil their face intentionally.

Finally, de-legitimizing other interpretations, al-Shinqīṭī concludes that God (*al-Shāri'*) prohibits women from unveiling their face before the *ajānib*, since the face is *aṣl al-jamāl* (the source of beauty) and looking at a young beautiful woman's face is a threshold into seduced human desire (*gharīzah basharīyah*) and might lead to unexpected occurrences. Al-Shinqīṭī goes further to briefly explain relevant topics—shaking hands with a woman and touching her body, both of which are not allowed.

Even though al-Shinqīṭī arrives at a dissimilar conclusion, just like al-Sa'dī and al-Jazā'irī, al-Shinqīṭi certainly shows his readers other ways of understanding the verses and provides them with a door to either support or criticize his interpretation.

[45]According to al-Shinqīṭī, the majority of Muslim scholars agree that the Prophet's wives had veiled their face even before the revelation of *ḥijāb* verse. Therefore this verse would be meaningless if one understands it as applying only to his wives.

Concluding Remarks

As far as the discussions on some of the issues around *ḥijāb* verses in the three Salafi tafsirs are concerned, one can arrive at a conclusion that these Salafi tafsirs are basically "textualist". Apart from a very limited discussion on *asbāb al-nuzūl* hadiths, they generally ignore the context of revelation and that of interpretation, and instead—in the case of al-Sa'dī's and al-Jazā'irī's tafsirs—focus on what the verses "textually" or "literally" mean or—like in the case of al-Shinqīṭī's tafsir—focus on providing Qur'an/hadith/*uṣūl*-based arguments to support this "literal" meaning. At best one could pay much attention to some of what Saeed calls as the "broad context" of the Qur'an, which also includes the overall content of the Qur'an,[46] in al-Shinqīṭī's *Aḍwā'*.

Nonetheless, though they essentially ignore the socio-historical contexts of the Qur'an in interpretation, Saeed's complete definition of textualism cannot fully be applied to all of these tafsirs since "*Taysīr*'s and *Aysar*'s textualism" neither overtly reflect much reliance on hadith nor approach the question of interpretation strictly from a linguistic perspective. Their textualism might be better described by another of Saeed's distinctions between the two forms of literalism, namely "soft" literalism and "wooden" literalism,[47] assuming that the latter can aptly describe this kind of textualism.

Above all, this kind of textualism or ignorance of the contexts in Salafi tafsirs might be attributed to their emphasis on the "generality" of the text (*'umūmiyyat al-alfāẓ*)—which is very noticeable in the interpretation of *ḥijāb* verses in al-Shinqīṭī's *Aḍwā'*. For Salafis, the text is considered to have superiority over the context. As is the case with many textualists, they focus more on "direct meaning" than "indirect meaning",[48] and treat the Qur'an more as "language" than as "discourse" (language in context).

While *Adwa'* might not be fittingly characterized "authoritarian" (at least "less authoritarian") as it shows the readers different interpretations of the text despite arriving at a dissimilar conclusion regarding the prohibition of gazing at an "unrelated" woman's body and the obligation of *ḥijāb*, *Taysīr* and *Aysar* seem to be more exposed to Abou El Fadl's "authoritarian/authoritative"

[46]See Saeed, *Interpreting the Qur'an*, 105. His distinction between "broad context" and "narrow context" is fairly comparable to Bint al-Shati's distinction between *al-siyāq al-'āmm* (general context) and *al-siyāq al-khāṣṣ* (specific context).

[47]Saeed, *Interpreting the Qur'an*, 113. "Soft" literalism emphasizes the literal meaning and makes it the basis for the exploration of the whole meaning of the text, while "wooden" literalism is "a rigid understanding of the literal meaning of the words without any regard to the complexities associated with meaning."

[48]For this distinction, see Saeed, *Interpreting the Qur'an*, 105.

criticism. Both tafsirs do not allow the reader to know other possible understandings of the interpreted text. There is a high degree of what Saeed terms "rigidity"[49] in these two tafsirs as both attempt to limit the meaning of ethico-legal text to one. Though, this might also be said of *Aḍwā'*—as is also the case with many modern textualists—which still contains rigidity since it—to borrow Saeed's words—"argues against the legitimacy of other possible meanings of the same text."[50]

The "authoritarian" nature in at least some of Salafi tafsirs to some extent might be attributed to their stated aim to "unite" the umma under a single, correct (and "simple") interpretation. However, from the critics's viewpoint, this surely means an act of "locking" the Divine Will. *Wa Allāh a'lam.*[]

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[49]Saeed, *Interpreting the Qur'an*, 104.

[50]It might be important to stress that their rigidity is much higher from some exegetes whose tafsirs many Salafis would consider as parts of Salafi tradition, such as al-Ṭabarī and Ibn Kathīr. This difference is also apparent in the interpretation of al-Nūr [24]: 30-31. See al-Ṭabarī, *Jāmi' al-Bayān*, vol. 9, 303-307; Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm*, vol. 10, 212-225.

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Syntheses via phenolic oxidative coupling using crude peroxidase from *Brassica juncea* (L) Czern leaves and antioxidant evaluation of dimeric thymol

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Abstract: The ability of a crude *Brassica juncea (L)* Czern peroxidase as green and edible catalyst for phenolic oxidative dimerization of thymol is presented. Crude peroxidase was isolated and partially purified using precipitation method with gradient concentration of ammonium sulphate and dry ice-acetone combination as temperature regulator. The crude peroxidase was then analyzed qualitatively and quantitatively using guaiacol as a model substrate and amino antypirin activity test, respectively, and the positive result was confirmed. From the phenolic oxidative reaction, dimerization of thymol was carried out under extremely mild reaction condition in aqueous medium. The product was checked by using Fourier Transform Infrared (FTIR) and Gas Chromatography-Mass Spectrometry (GC-MS). Furthermore, the biological activity test using DPPH radical scavenging method was confirmed that the dimeric thymol showed 15 times greater than monomeric thymol in term of antioxidant capacity.

Keywords: *Brassica juncea;* peroxidase; oxidative coupling; dimeric thymol; antioxidant.

Introduction

Peroxidases (PODs), that widely distributed in plants species [1], are oxidoreductases that catalyzes a reaction in which hydrogen peroxide (H_2O_2) act as the acceptor and another compound acts as the donor of hydrogen atoms [2-4]. Most of them are heme proteins that contain iron (III) protoporphyrin IX (ferriprotoporphyrin IX) as the prostetic group [1,3]. It plays a significant role in the plant defense system by converting phenolic compounds to quinones, which are toxic to pathogenic organisms and pests. Plant differentiation and development are also regulated by this type of enzymes[5] together with other class of enzymes. Peroxidases have been reported to present in both soluble and membrane-bound forms [6,7]. PODs from several plants have been purified and studied, for example, oil palm leaf [8], sweet potato tubers [9], turnip [10-11], melon [12], Brussels sprouts [13-14], cabbage [15], barley [16], okra [17], oranges [18], tea leaves [19], pepper fruits [20], carrot roots [21], tobacco [22], wheat germ [23], mango [24], green pea [25-26], papaya fruit [27], spinach [28], Cox's apple pulp [29], rice [30], cotton [31], peanut [32], tomato [33-34], green asparagus [35], strawberry [36].

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In the presence of peroxide, for example hydrogen peroxide, PODs from plant tissues are able to oxidize a wide range of phenolic compounds, such as guaiacol, pyrogallol, chlorogenic acid, catechin and catechol [37]. One type of chemical reaction that catalyzed by peroxidases is coupling oxidative of phenolic. Phenolic compounds such as eugenol and guaiacol act as hydrogen donor and then forms a species, called phenoxy radical. This species is relatively unstable and get stabilisation by making dimeric compound via coupling. The previous research published by Anita et al. studied dimerisation of guaiacol to O-para guaiacol by crude of *Brassica oleracea* var *alboglabra* peroxidase [38].

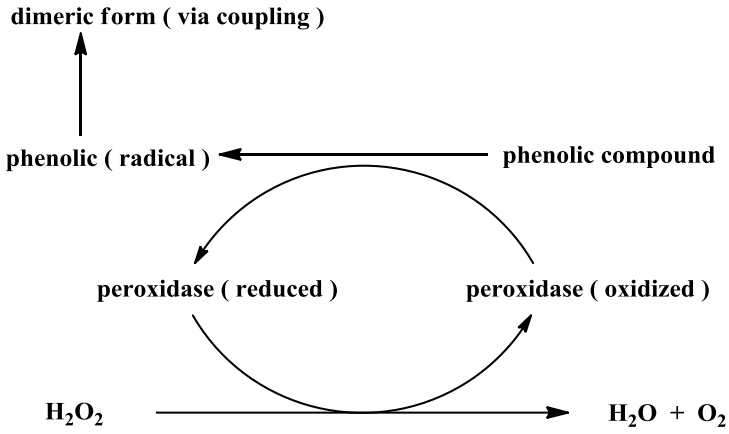


Figure 1. Scheme of phenolic oxidative coupling catalyzed by peroxidase

In this paper, we reported the isolation and partial purification of peroxidase from *Brassica juncea*. The crude enzyme was then applied in catalyzing oxidative coupling dimerisation of thymol in aqueous medium. Formation of dimeric thymol via carbon-carbon coupling was confirmed by LC-MS spectrometry, and the potential bioactivity of dimeric thymol as antioxidant has also been studied.

Experimental Section

General and Instrumentation

Fresh *Brassica juncea* was collected from local market. All chemicals were purchased from commercial suppliers, analytical grade, and used without any further purification. Analytical Thin Layer Chromatography (TLC) was performed on Merck silica gel 60 F_{254} plates. Fragmentation of dimeric thymol was recorded using Gas Chromatography – Mass Spectrometry (LC-MS) and infrared spectra was recorded on Shimadzu Prestige-21 Fourier Transform Infrared (FTIR) spectrophotometer. The condition of GC-MS analysis : DB column (30 m x 0.25 mm), carrier gas He, 1.2 mL/min constant flow, heating 40°C for 2 min, 40-100 $^{\circ}$C at 40 $^{\circ}$C/ min, 100-140 $^{\circ}$C at 2 $^{\circ}$C/ min, 140-340 $^{\circ}$C at 30 $^{\circ}$C/ min, system injector split 200$^{\circ C}$, system detector MSD 320$^{\circ C}$.

Isolation and Partial Purification of Peroxidase

Brassica juncea (250 g) was washed using distilled water to remove the physical impurities, and the rest was carefully cut into smaller size with an ordinary kitchen peeler, the phosphate buffer was added and the mixture was blended for 5 minutes at -4°C.

The homogenate was then filtered, and the filtrate was collected using a 250 mL beaker glass. The filtrate was purified using fractional precipitation method. The gradient concentration of ammonium sulfate (30, 50, and 70%) was used as precipitator, and temperature of environment was adjusted approximately to -30°C using dry ice-acetone.

Determination of Total Protein Concentration

Total protein content in the enzymatic system was performed using Lowry method with albumin from bovin (BSA) as protein standard. A crude peroxidase extract (1 mL) was added into 5 mL of Lowry reagent (mixture of 2 g of Na_2CO_3 in 100 mL of NaOH 0.1 N and 0.25 g of $CuSO_4.5H_2O$ in 50 mL of 1% K-Na tartrate solution). The mixture was stirred and let stand for 10 minutes. A 0.5 mL of 1N Folin solution was added carefully, let stand for 30 minutes, and the absorption was measured using UV-Vis spectrophotometer at 750 nm.

Qualitative Analysis of Crude Peroxidase Activity Using Guaiacol

Crude peroxidase activity was semiquantitatively determined using guaiacol as a model substrate. Various of stock enzyme solution (1, 2 and 4 mL) and guaiacol (0.2 mL) were added to a test tube containing 0.4 mL of 30% hydrogen peroxide. The mixture was shaken vigorously about 2 minutes, and the red colour was appeared after 30 s reaction time. The reaction were monitored by reading the increase in absorbance at 460 nm using Shimadzu 2450 double beam ultraviolet-visible (UV-Vis) spectrophotometer.

Determination of Specific Activity of Crude Peroxidase

2.5 mL of 2.5 μM 4-aminoantipyrin in phenol and 2.0 mL of 30% hydrogen peroxide were added into 0.2 mL of crude peroxidase. The mixture was incubated in boiling water for 2 min. The mixture of 4-aminoantipyrin, hydrogen peroxide and phosphate buffer pH 7.0 was used as control solution. The absorbance was recorded at 510 nm. Specific activity of crude peroxidase was calculated using the following equation :

$$\textbf{Specific activity} = \frac{\textbf{absorbance at 510 nm}}{\textbf{6.58 x total protein content (in mg/mL)}}$$

Dimerisation of Thymol

Two test tubes were prepared in this reaction procedure. The first tube as negative control which contains 5 mL of phosphate buffer pH 7.0 and the second test tube contains 5 mL of crude peroxidase. A 1.0 mL of thymol solution (1 M) was added into each test tube, followed by the addition of 0.1 mL of 30% hydrogen peroxide. The reactions were monitored using TLC analysis. After completion, crude product was extracted using ethyl acetate (2x50 mL). The combined fraction was dried over anhydrous Na_2SO_4. The product was concentrated, and the rest was purified using flash colum chromatography to get the pure dimeric thymol. Structure elucidation of product was performed using GC-MS and FTIR.

Antioxidant Assay

Antioxidant activity of thymol and dimeric thymol was determined using DPPH radical scavenging method. The DPPH radical-scavenging activities were assessed as described previously [39] with major modification. Briefly, 1.0 mL DPPH radical (0.5 mM) was mixed with 1.0 mL of thymol or dimeric thymol solution (in methanol). The volume of the mixture

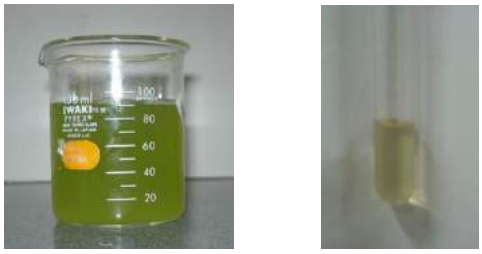
was adjusted to 5 mL by adding methanol. The concentration of thymol were varied from 1, 5 and 15 ppm, and dimeric thymol from 0.25, 0.5 and 1 ppm. The reaction was carried out at room temperature for 25 minutes. The decrease of DPPH radical concentration was monitored every 5 minutes by measuring the absorbance at 517 nm with a UV-Vis spectrophotometer (Shimadzu 2450 double beam). Antioxidant activity was measured as the decrease of DPPH radical concentration caused by the addition of sample (thymol or dimeric thymol), and was expressed as percent inhibition. The value of percent inhibition was calculated by following equation :

$$\% \text{ inhibition} = \frac{A_{\text{control solution}} - A_{\text{sample}}}{A_{\text{control solution}}} \times 100\%$$

Results and Discussion

Isolation and Determination of Specific Activity of Crude Peroxidase

Crude extract of *Brassica juncea* peroxidase has green colour. It signify the presence of impurities such as debris cells from it leaves. Partial purification was performed using gradient concentration of ammonium sulphate at approximately -30°C of environmetal temperature. Result of purification using 30% (by mass) ammonium sulphate solution, called fraction I. Fraction I was then followed by second and third purification stages using 50% and 70% (by mass) of ammonium sulphate, and called enzyme fraction II and III, respectively. Fraction III was used in this experiment in catalyzing oxidative dimerisation of thymol. Before used, determination of total protein content, qualitative analysis and specific activity of fraction III was perfomed and give the following result as described in the next paragraph.



a b

Figure 2. Crude extract of *B. juncea* peroxidase (a) and peroxidase fraction III (b)

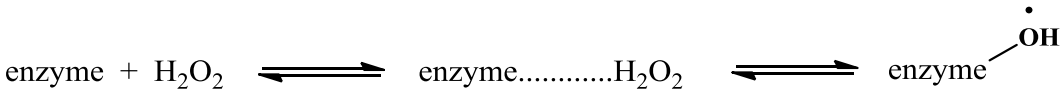
Qualitative analysis using guaiacol shows the positive result. The increase of absorbance at 460 nm (dimeric guaiacol) was recorded. The absorbance increase in the addition of more volume of fraction III peroxidase, as shown in the Table 1

Table 1 : the increase of absorbance at 460 nm in qualitative analysis of enzyme fraction III

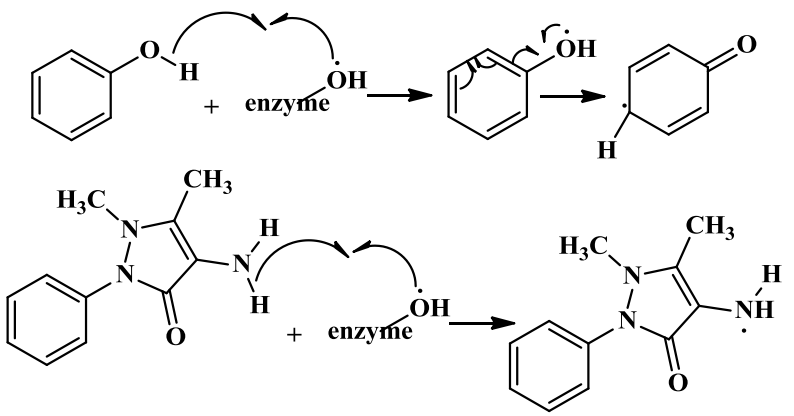
No.	Volume of fraction III (mL)	Volume of guaiacol (mL)	Absorbance at 460 nm
1	1	0.2	1.50
2	2	0.2	1.60
3	4	0.2	3.80

Total protein content of fraction III was determined using Lowry method and was found to be 0.59 mg/mL. As a part in determination of specific activity, peroxidase fraction III reacts with 4-aminoantipyrin (in phenol) which is act as hydrogen donor. This reaction can be observed because there is a change of colour solution to red colour, and monitored at 510 nm using UV-Vis spectrophotometer. the red colour formed is related to the presence of quinoneimine compound. From the quiantification using UV-Vis, absorbance at 510 nm was found to be 2.29. Therefore, by using formula given in experimental section, the specific activity of peroxidase fraction III was found to be 0.59 (unit/mg). The reaction mechanism of enzyme and 4-aminoantipyrin can be illustrated below.

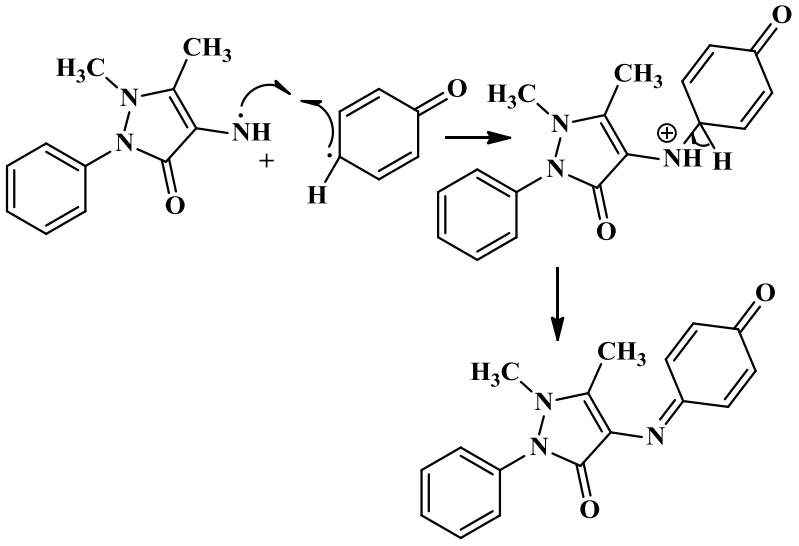
Stage 1 : initiation



Stage 2 : propagation



Stage 3 : termination



Quinoneimine (red)

Figure 3. proposed mechanism in determination of specific activity using 4-aminoantipyrin

Dimerisation of Thymol and Structure Elucidation

We presented a simple and green organic synthesis of dimeric form of thymol via radical C-C oxidative coupling using peroxidase isolated from *Brassica juncea* leaves. The reaction mixture of thymol, hydrogen peroxide and *B. juncea* peroxidase in aqueous medium containing phosphate buffer pH 7.0 was magnetically stirred, and the colour of solution change to orange after 30 minutes reaction time. The completion of the reaction reach after 1.5 hour reaction time. TLC analysis suggested the formation of new compound with higher polarity compared to starting material (thymol) and identified at Rf value of 0.47 (using n-hexane : ethyl acetate 6 : 1 as eluent). The crude product was extracted using ethyl acetate, the solid was purified by column chromatography using silica gel to get the pure desirable product.

Figure 4. Colour change in dimerisation of thymol using *B. juncea* peroxidase

The product was then analyzed using FTIR and GC-MS to confirm the structure of the product. The result of FTIR analysis as summarized in the Table 2. From FTIR analysis, there is no the significant change of IR absorption between thymol and desirable product (dimeric thymol) because both of them has no difference in functional group. We need more chemical instumentation to elucidate the structure of product.

Table 2 : Some of Important IR absorption of thymol and dimeric thymol

No.	**Wavenumber (cm^{-1})**		**Functional group**
	thymol	**dimeric thymol**	
1	3201.0	3418.4	-OH stretch
2	2962.2 ; 2929.7	2958.4 ; 2925.8	C-H sp^3 stretch
3	1619.4	1620.9	Aromatic ring
4	1428.5	1422.4	C-H sp^3 bend
5	1358.5	1379.9	Isopropyl, $-C(CH_3)_2$
6	1159.1	1155.0	C-O single bond stretch
7	733.8	739.2	2 or 3 substituted benzene

From the GC-MS analysis, there are four main peaks with the retention time 15.03 min (m/z 150), 16.64 min (m/z 278), 26.08 (m/z 198), and 28.54 min (m/z 298). The molecular mass analysis, signify that compound which has retention time 15.03 related to thymol structure with Mr 150 g/mol. The fragment with m/z 298 is suggested as dimeric structure of thymol after two thymol radical coupled together. Fragment m/z 298 = 2 x Mr thymol (150) minus two hydrogen atom. Fragment m/z 298 was then followed by some more fragmentation and has several main peaks at m/z 283, 241, 149, 123, 91, and 77 as shown on the picture below. The molecular cation m/z 298 fragmented to m/z 283 by losing one methyl group (-CH_3), molecular cation m/z 298 also fragmented in different pathway to form m/z 241 by losing isopropyl and –CH_2-. The molecular cation fragment m/z 298 was broken in C-C biphenyl bond to give fragment of m/z 149, corresponding to the cationic radical of thymol.

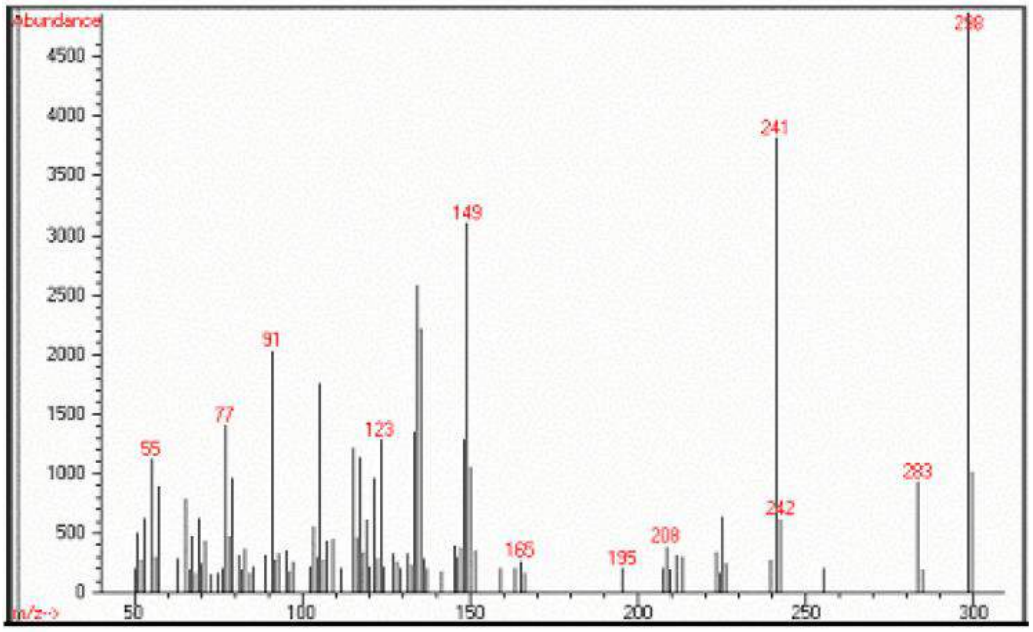


Figure 5. Mass spectra of dimeric thymol

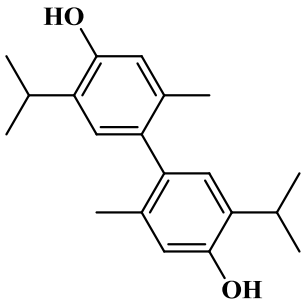


Figure 6. Structure of dimeric thymol

The mechanism of dimeric thymol formation can be described by the following processes. Peroxidase reacts with hydrogen peroxide as acceptor to form oxidized enzyme. Thymol as hydrogen donor give one hydrogen to the enzyme. Therefore, the enzyme is reduced and the thymol is oxidized to thymol radical (phenoxy, in general). Thymol radical stabilize it self by coupling with other thymol radical to form dimeric thymol.

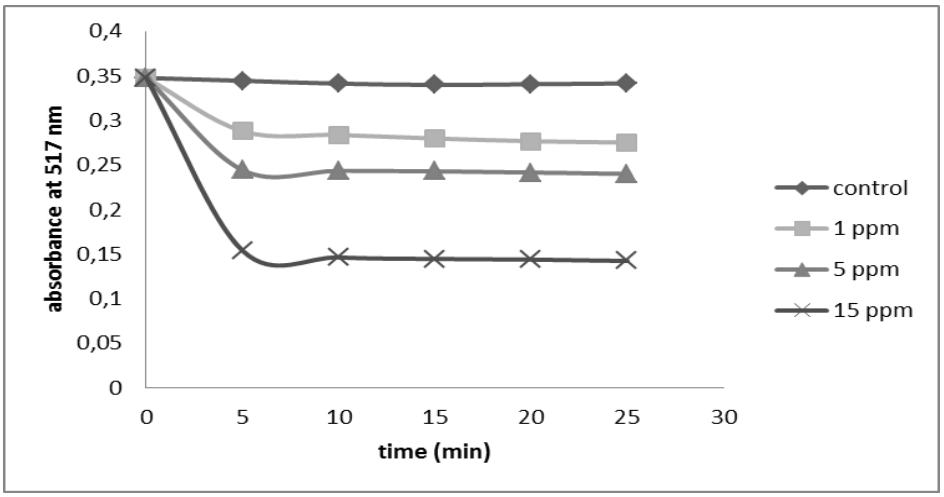
Antioxidant Activity of Thymol and Dimeric Thymol

Phenolics share the same general structure composed of an aromatic hydroxyl nucleus and exist in an approximated number of 8000 in nature. So far, plant phenolics constitute one of major groups of compounds acting as primary antioxidants or free radical terminators [40]. Antioxidant activity is defined as the ability of a compound to inhibit oxidative degradation like lipid peroxidation [40-41]. There are several method in determining of antioxidant activity of certain compound, such as ABTS scavenging activity [42], DMPD assay [43], cupric ion (Cu^{2+}) reducing assay [44-45], chelating activity of ferrous ion (Fe^{2+}) [46], and DPPH assay. The antioxidant activity of dimeric thymol and thymol were evaluated by the neutralizing of DPPH, a model of radical compound [47-48]. In DPPH assay, the antioxidants were able to reduce the stable radical DPPH (violet-coloured) to the yellow-coloured diphenyl-picrylhydrazine. This method is based on the reduction of DPPH in methanolic solution in the presence of a hydrogen-donating compound due to the formation of non-radical form of DPPH. The decrease of radical DPPH absorbance can be monitored quantified at 517 nm. The decrease of DPPH absorbance can be tabulated below.

Table 3. The decrease of DPPH absorbance at 517 nm as a function of time

time (min)	**absorbance of DPPH caused by addition of sample**						
	control	**thymol (ppm)**			**dimeric thymol (ppm)**		
		1	**5**	**15**	**0.25**	**0.5**	**1**
0	0.34755	0.34755	0.34755	0.34755	0.34755	0.34755	0.34755
5	0.34440	0.28788	0.24425	0.15400	0.29596	0.25244	0.14162
10	0.34119	0.28363	0.24355	0.14637	0.29370	0.25047	0.13037
15	0.33975	0.27969	0.24291	0.14465	0.29197	0.24641	0.12433
20	0.34051	0.27665	0.24157	0.14388	0.29079	0.24530	0.12100
25	0.34144	0.27511	0.23998	0.14239	0.28154	0.24406	0.11838

Table 3 illustrates a significant decrease in the concentration of DPPH radical due to scavenging ability of dimeric thymol. A 0.5 ppm of dimeric thymol has same ability of 5 ppm of thymol in decreasing the absorbance of DPPH from 0.34755. this indicates the effectiveness of dimeric thymol compared to monomeric of thymol structure, in term of ability in donating hydrogen atom to the radical. IC_{50} values for monomeric and dimeric structure of thymol were found as 12.08 and 0.77 ppm. A lower IC_{50} value indicates a higher DPPH free radical scavenging activity. DPPH scavenging capacity of dimeric thymol 15 times higher monomeric thymol.



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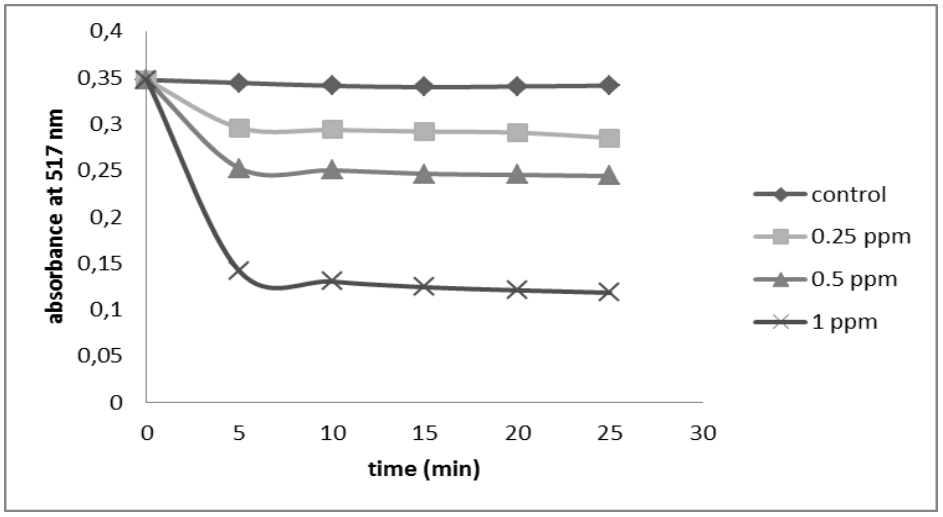

b

Figure 7. The decrease of DPPH radical absorbance caused by the addition of a sample (a) thymol and (b) dimeric thymol

Table 4. IC_{50} values for monomeric and dimeric thymol

Tested compound	**Antioxidant activity using DPPH method (IC_{50}, ppm)**
Thymol	12.08
Dimeric thymol	0.77

Conclusion

The oxidative coupling dimerisation of thymol was succesfully achieved by using crude extract of *Brassica juncea* peroxidase as edible catalyst in the presence of hydrogen peroxide. Dimeric thymol was identified using GC-MS spectrometry at retention time 28.54 minutes with m/z value of 298. From antioxidant assay, dimeric structure of thymol has greater antioxidant capacity compared to thymol about 15 times. Biocatalytic dimerisation using crude peroxidase from plants provides a new way to synthesis organic molecules with interesting biological performances.

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The Relationship between Field Dependence-Independence and Reading Strategy toward Reading Comprehension

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This study investigated the relationship between learning style (X_1) and reading strategy (X_2) toward reading comprehension (Y). The learning style is categorized into two: field independence (FI) and field dependence (FD). This study was carried out in one of the public senior high schools in Jakarta by using purposive sampling technique; 79 out of 120 students of science class in academic year 2008-2009 were chosen. The quantitative and qualitative methods were used to analyze the data. Questionnaires and one reading comprehension test were distributed to analyze the data quantitatively. The first instrument identified students belonging to FI or FD. The second instrument concerned with identifying the frequency of reading strategy that students mostly used. 20 numbers of reading comprehension test were given to measure the comprehension and strategy that they used. This study found that both learning style (X_1) and reading strategy (X_2) influenced the reading comprehension (Y). In other words, the more independent students are and the more frequent they use strategy, the greater they will comprehend the text. As a consequence, the findings suggest that teachers introduce various kinds of strategy in reading comprehension because every student needs particular strategy.

Keywords: learning style, field-independence, field dependence, reading strategy, reading comprehension

Studi ini mencari hubungan antara tipe belajar (X_1) dan strategi membaca (X_2) terhadap kemampuan membaca (Y). Tipe belajar dibagi menjadi dua: 'field independence' (FI) dan 'field dependence' (FD). Studi ini dilakukan di salah satu SMA di Jakarta dengan menggunakan teknik sampel purposif. 79 dari 120 siswa jurusan IPA tahun akademik 2008-2009 dipilih. Metode kualitatif dan kuantitatif digunakan untuk menganalisa data. Kwestioner dan tes membaca diberikan untuk menganalisa data secara kuantitatif. Instrumen pertama digunakan untuk membagi siswa ke dalam FI dan FD. Instrumen kedua digunakan untuk mengidentifikasi frekuensi strategi membaca yang

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Infusing Critical Thinking into English Coursebooks

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Though critical thinking has been officially written as one of educational objectives in Indonesia as written in the Regulation of the Republic of Indonesia Number 17 Year 2010 Regarding Educational Management and Administration, it seems that schoolteachers in this country still do not understand what it is and do not realise the importance of critical thinking for students and professionals of this country. This might be because there is no clear conception of what kind of critical thinking needed in education in this country, or it may be because Indonesian schoolteachers do not really know how to encourage students' critical thinking as they may be still confused with this concept as mentioned above. The latest 2013 curriculum, however, seems to have accommodated the infusion of critical thinking into school subjects, as can been seen in the adoption of Bloom's taxonomy. This article therefore attempts to argue what critical thinking can contribute to Indonesian students and people as well as proposes reading activities based on Ilyas' critical thinking framework. This framework is the result of synthesising, examining and evaluating critical thinking taxonomies, strategies, programmes and tests.

Keywords: critical thinking, critical thinking framework, Indonesian education, coursebooks

Meskipun berfikir kritis (critical thinking) telah dimasukan ke dalam salah satu tujuan pendidikan di Indonesia yang tertulis dalam Peraturan Pemerintah Nomor 17 Tahun 2010 Tentang Pengelolaan dan Administrasi Pendidikan, guru-guru sekolah di Indonesia nampaknya belum benar-benar memahami apa itu berfikir kritis dan belum menyadari pentingnya berfikir kritis bagi siswa dan professional di negeri ini. Hal ini mungkin disebabkan tidak jelasnya konsep berfikir kritis seperti apa yang dibutuhkan dunia pendidikan Indonesia, atau mungkin juga disebabkan guru yang belum mengerti bagaimana mendorong siswa berfikir kritis karena mereka sendiri belum memahami konsep berfikir kritis, seperti yang telah disebutkan di atas. Kurikulum 2013 nampaknya telah memasukan berfikir kritis, dengan diadopsinya taksonomi Bloom dalam kurikulum tersebut. Oleh karena itu

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Developing Native-Like Listening Comprehension Materials: Teachers' and Pupils' Perceptions of a Digital Approach

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This paper reported the attempt teachers did in developing native-like (NLS) listening materials for their EFL learners using a text-to-speech (TTS) technology. Observation was carried out to record teachers' procedures for developing NLS materials. Interview with teachers were undertaken to explore their' perceptions towards the NLS listening materials and the benefits they gained from developing instructional media using technology. In addition, a questionnaire was distributed to 65 eight-grade pupils to gather information related to their opinions regarding the listening materials developed and used by their teachers. The findings show that teachers and pupils responded positively towards the NLS materials for listening comprehension. In addition, teachers were found to have more confidence in teaching listening skill while using the technology. There are three conditions which endorse this teaching confidence: the suitability of instructional materials used with the learning curriculum and pupils' level of English proficiency, teachers' self-efficacy to the teaching task, and the integration of technology in classroom teaching. The study suggests that TTS system can be used as computer assisted language learning (CALL) application particularly in the development of listening comprehension materials. The study also confirms earlier studies that teacher professional development can be promoted through integrated training on technology for classroom use.

Keywords: Native-like speaker (NLS), listening materials, text-to-speech (TTS), English as a foreign language (EFL)

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The Relationship between Authentic Materials and Cooperative Learning Strategy towards EFL Students' Reading Comprehension

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EFL (English as a Foreign Language) students of vocational high schools are requested to have skillful reading strategies to comprehend specific texts in English. To have a good comprehension, they utilize not only their strategies but also interesting and suitable texts. Therefore, this current study investigated the correlation between students' perception of the authentic materials and cooperative learning strategy towards students' reading comprehension. The data of the reading comprehension tests and the students' perception were analyzed using the multiple regression. The result revealed that (1) there was positive correlation between students' perception of the authentic materials and students reading comprehension, (2) there was significant positive effect of cooperative learning strategy towards reading comprehension, and (3) there was significant positive effect of reading materials towards cooperative learning strategy. These findings suggested that the choice of authentic materials could motivate students to comprehend ESP texts. Besides this, by doing cooperative learning strategy, the scaffolding could happen so that they could share their comprehension. In spite of its limitation, this study could have certain pedagogical implications to reading classroom activities.

Keywords: authentic materials, cooperative learning strategy, reading comprehension

Siswa yang belajar bahasa Inggris di Sekolah Menengah Kejuruan (SMK) diharapkan memiliki kemampuan membaca teks dalam bahasa Inggris. Untuk memiliki kemampuan tersebut, siswa perlu mengetahui tidak hanya strategi membaca tetapi juga tertarik dengan teks yang dibacanya. Oleh karean itu riset ini melihat hubungan antara persepsi siswa terhadap teks otentik dan strategi belajar kooperatif dengan kemampuan membaca siswa. Hasil tes

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An Indonesian Child Learning Sentence Construction

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This study investigates the language acquisition of an Indonesian child (a boy, aged 6 years) who learns and uses English (in Indonesia/Jakarta) inside and outside the classroom. This child regularly watches his favorite English movies such as *Disney Channel* and *Nickelodeon* from cable TV, and he frequently communicates in English at home, particularly with his only younger brother and mother. The data were collected for 18 months by recording his spontaneous speech. The data were transcribed then analyzed to see the development of his English syntactic constructions: i.e. infinitival and sentential complements. These types of constructions are chosen to investigate since it is not always easy for EFL learners to learn these constructions. The findings of this study show that the development of these constructions is enormous: the process of his learning English can be similar (if not the same) to that of English Children. It is because this child and the English children basically share common principles (sufficient exposure to and practices of English) of learning the language.

Keywords: child's foreign language development, language acquisition, sentence construction

Studi ini meniliti pemerolehan bahasa anak laki-laki (6 tahun) Indonesia yang belajar bahasa Inggris di dalam dan di luar kelas. Anak tersebut secara teratur menonton film favoritnya, seperti Disney Channel dan Nickelodeon, melalui kabel TV dan berkomunikasi di rumah, khususnya dengan adik laki-laki dan ibunya. Data dikumpulkan dalam waktu 18 bulan dengan merekam ucapan spontan-nya. Ucapan tersebut diketik dan dianalisa untuk melihat perkembangan konstruksi sintaksis bahasa Inggrisnya, yaitu 'infinitival dan sentential complements'. Konstruksi ini diteliti karena tidak mudah bagi pembelajar bahasa Inggris sebagai bahasa asing untuk mempelajarinya. Penemuan studi ini menunjukan bahwa perkembangan pemerolehan konstruksi ini sangat luar biasa: proses pemerolehan bahasa Inggris oleh anak dari negara yang tidak berbahasa Inggris sama dengan pemerolehan bahasa Inggris oleh anak yang tinggal di negara berbahasa Inggris. Ini karena anak Indonesia tersebut dan anak-anak di negara

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Learning Vocabulary through Paper and Online-Based Glossary

Ratih Novita Sari*
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This study examined the effect of teaching glossary and personality traits on vocabulary learning. Two groups of students who had different personality (extroverted and introverted) were exposed to two types of glosses: paper and online-based glossary. The two groups underwent two-month treatment. Prior to and after the treatment, each group was given pre and posttest. In calculating the data, two-way ANOVA was used. The results of the study showed that extroverted students learned vocabulary better through paper-based glossary, while introverted students learned vocabulary better through online-based. Further research needs to be conducted to determine whether age influences the use of teaching glossary or not.

Keywords: personality learning style, introvert and extrovert, paper-based glossary, online-based glossary.

Studi ini meneliti pengaruh pengajaran menggunakan glossary dan kepribadian terhadap pembelajaran kosa kata. Dua kelompok siswa yang memiliki kepribadian berbeda (extrovert dan introvert) diberikan dua tipe glossary: glossary berbasis online dan kertas. Dua kelompok tersebut diajarkan selama dua bulan. Sebelum dan sesudah perlakuan, setiap kelompok diberikan tes awal dan akhir. ANOVA dua arah dipergunakan untuk menghitung data. Hasil studi ini menunjukan bahwa dalam pembelajaran kosa kata, siswa extrovert lebih mudah belajar dengan menggunakan glossary berbasis kertas, sedangkan siswa introvert lebih cepat belajar kosa kata melalui online. Studi lanjutan perlu dilakukan untuk mengetahui apakah usia juga berpengaruh terhadap pembelajaran menggunakan glossary.

INTRODUCTION

Realizing that vocabulary mastery is important, teachers could be the one responsible for increasing their students' vocabulary mastery. They need to provide students with vocabulary learning activities both inside and the outside classroom. Based on the pre-observation at one of junior secondary schools in Bandar Lampung Province, Indonesia, it was found that some

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Drama in the EFL Classroom: Critical Review of the Literature

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This article presents critical review of three empirical studies on the use of drama in language learning. Results of those studies are very supportive to integrate drama into EFL. Also, the results of the studies are in agreement with the ideas stating that drama can give positive contributions to students' language proficiency. In fact, apart from improving students' language skills, drama can promote collaboration and negotiation. Given the advantages of using drama in the EFL classroom shown by those studies, there is little information concerning the use of drama in the Indonesian EFL.

Keywords: drama, EFL, critical review

Artikel ini tentang tinjauan kritis tiga penelitian empiris tentang penggunaan drama dalam pembelajaran bahasa. Hasil dari penelitian tersebut sangat mendukung penggunaan drama dalam pembelajaran bahasa Inggris untuk penutur asing (EFL). Hasil penelitian tersebut juga sama dengan gagasan yang menyatakan bahwa drama dapat memberikan kontribusi positif terhadap penguasaan bahasa. Pada kenyataannya, selain meningkatkan kemampuan bahasa siswa, drama dapat mempromosikan kolaborasi dan negosiasi. Meskipun banyak keuntungan penggunaan drama dalam EFL yang ditunjukan oleh penelitian tersebut, informasi tentang penggunaan drama dalam EFL di Indonesia masih belum banyak.

INTRODUCTION

The role of literature in the EFL (English as a Foreign Language) classroom has been acknowledged by many authors (e.g. Campbell, 1987; Ilyas, 2016; Melin, 2010; Picken, 2007; Shelton-Strong, 2012; Yang, 2002). The term EFL herein also refers to ESL (English as a Second Language). EFL teachers can design classroom activities which can, for instance, promote tolerance & critical thinking (Ilyas, 2016) and language acquisition (Shelton-Strong, 2012). In a study conducted by Yang (2002) on using science fiction in the EFL classroom, the author found that:

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Syntheses via phenolic oxidative coupling using crude peroxidase from *Brassica juncea* (L) Czern leaves and antioxidant evaluation of dimeric thymol

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Abstract: The ability of a crude *Brassica juncea (L)* Czern peroxidase as green and edible catalyst for phenolic oxidative dimerization of thymol is presented. Crude peroxidase was isolated and partially purified using precipitation method with gradient concentration of ammonium sulphate and dry ice-acetone combination as temperature regulator. The crude peroxidase was then analyzed qualitatively and quantitatively using guaiacol as a model substrate and amino antypirin activity test, respectively, and the positive result was confirmed. From the phenolic oxidative reaction, dimerization of thymol was carried out under extremely mild reaction condition in aqueous medium. The product was checked by using Fourier Transform Infrared (FTIR) and Gas Chromatography-Mass Spectrometry (GC-MS). Furthermore, the biological activity test using DPPH radical scavenging method was confirmed that the dimeric thymol showed 15 times greater than monomeric thymol in term of antioxidant capacity.

Keywords: *Brassica juncea;* peroxidase; oxidative coupling; dimeric thymol; antioxidant.

Introduction

Peroxidases (PODs), that widely distributed in plants species [1], are oxidoreductases that catalyzes a reaction in which hydrogen peroxide (H_2O_2) act as the acceptor and another compound acts as the donor of hydrogen atoms [2-4]. Most of them are heme proteins that contain iron (III) protoporphyrin IX (ferriprotoporphyrin IX) as the prostetic group [1,3]. It plays a significant role in the plant defense system by converting phenolic compounds to quinones, which are toxic to pathogenic organisms and pests. Plant differentiation and development are also regulated by this type of enzymes[5] together with other class of enzymes. Peroxidases have been reported to present in both soluble and membrane-bound forms [6,7]. PODs from several plants have been purified and studied, for example, oil palm leaf [8], sweet potato tubers [9], turnip [10-11], melon [12], Brussels sprouts [13-14], cabbage [15], barley [16], okra [17], oranges [18], tea leaves [19], pepper fruits [20], carrot roots [21], tobacco [22], wheat germ [23], mango [24], green pea [25-26], papaya fruit [27], spinach [28], Cox's apple pulp [29], rice [30], cotton [31], peanut [32], tomato [33-34], green asparagus [35], strawberry [36].

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In the presence of peroxide, for example hydrogen peroxide, PODs from plant tissues are able to oxidize a wide range of phenolic compounds, such as guaiacol, pyrogallol, chlorogenic acid, catechin and catechol [37]. One type of chemical reaction that catalyzed by peroxidases is coupling oxidative of phenolic. Phenolic compounds such as eugenol and guaiacol act as hydrogen donor and then forms a species, called phenoxy radical. This species is relatively unstable and get stabilisation by making dimeric compound via coupling. The previous research published by Anita et al. studied dimerisation of guaiacol to O-para guaiacol by crude of *Brassica oleracea* var *alboglabra* peroxidase [38].

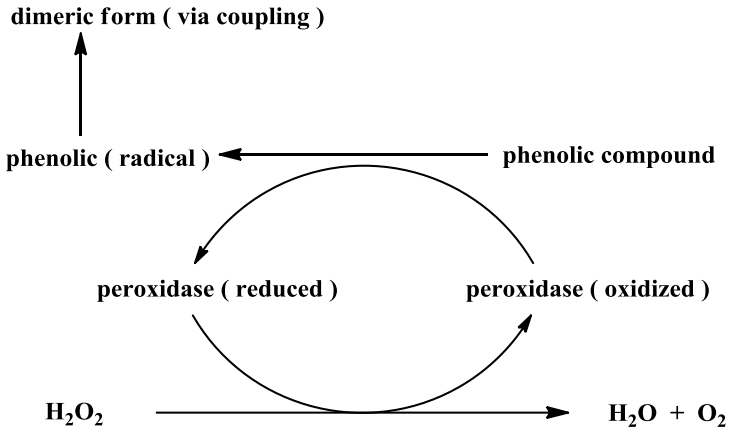


Figure 1. Scheme of phenolic oxidative coupling catalyzed by peroxidase

In this paper, we reported the isolation and partial purification of peroxidase from *Brassica juncea*. The crude enzyme was then applied in catalyzing oxidative coupling dimerisation of thymol in aqueous medium. Formation of dimeric thymol via carbon-carbon coupling was confirmed by LC-MS spectrometry, and the potential bioactivity of dimeric thymol as antioxidant has also been studied.

Experimental Section

General and Instrumentation

Fresh *Brassica juncea* was collected from local market. All chemicals were purchased from commercial suppliers, analytical grade, and used without any further purification. Analytical Thin Layer Chromatography (TLC) was performed on Merck silica gel 60 F_{254} plates. Fragmentation of dimeric thymol was recorded using Gas Chromatography – Mass Spectrometry (LC-MS) and infrared spectra was recorded on Shimadzu Prestige-21 Fourier Transform Infrared (FTIR) spectrophotometer. The condition of GC-MS analysis : DB column (30 m x 0.25 mm), carrier gas He, 1.2 mL/min constant flow, heating 40°C for 2 min, 40-100 $^{\circ}$C at 40 $^{\circ}$C/ min, 100-140 $^{\circ}$C at 2 $^{\circ}$C/ min, 140-340 $^{\circ}$C at 30 $^{\circ}$C/ min, system injector split 200$^{\circ C}$, system detector MSD 320$^{\circ C}$.

Isolation and Partial Purification of Peroxidase

Brassica juncea (250 g) was washed using distilled water to remove the physical impurities, and the rest was carefully cut into smaller size with an ordinary kitchen peeler, the phosphate buffer was added and the mixture was blended for 5 minutes at -4°C.

The homogenate was then filtered, and the filtrate was collected using a 250 mL beaker glass. The filtrate was purified using fractional precipitation method. The gradient concentration of ammonium sulfate (30, 50, and 70%) was used as precipitator, and temperature of environment was adjusted approximately to -30°C using dry ice-acetone.

Determination of Total Protein Concentration

Total protein content in the enzymatic system was performed using Lowry method with albumin from bovin (BSA) as protein standard. A crude peroxidase extract (1 mL) was added into 5 mL of Lowry reagent (mixture of 2 g of Na_2CO_3 in 100 mL of NaOH 0.1 N and 0.25 g of $CuSO_4.5H_2O$ in 50 mL of 1% K-Na tartrate solution). The mixture was stirred and let stand for 10 minutes. A 0.5 mL of 1N Folin solution was added carefully, let stand for 30 minutes, and the absorption was measured using UV-Vis spectrophotometer at 750 nm.

Qualitative Analysis of Crude Peroxidase Activity Using Guaiacol

Crude peroxidase activity was semiquantitatively determined using guaiacol as a model substrate. Various of stock enzyme solution (1, 2 and 4 mL) and guaiacol (0.2 mL) were added to a test tube containing 0.4 mL of 30% hydrogen peroxide. The mixture was shaken vigorously about 2 minutes, and the red colour was appeared after 30 s reaction time. The reaction were monitored by reading the increase in absorbance at 460 nm using Shimadzu 2450 double beam ultraviolet-visible (UV-Vis) spectrophotometer.

Determination of Specific Activity of Crude Peroxidase

2.5 mL of 2.5 μM 4-aminoantipyrin in phenol and 2.0 mL of 30% hydrogen peroxide were added into 0.2 mL of crude peroxidase. The mixture was incubated in boiling water for 2 min. The mixture of 4-aminoantipyrin, hydrogen peroxide and phosphate buffer pH 7.0 was used as control solution. The absorbance was recorded at 510 nm. Specific activity of crude peroxidase was calculated using the following equation :

$$\textbf{Specific activity} = \frac{\textbf{absorbance at 510 nm}}{\textbf{6.58 x total protein content (in mg/mL)}}$$

Dimerisation of Thymol

Two test tubes were prepared in this reaction procedure. The first tube as negative control which contains 5 mL of phosphate buffer pH 7.0 and the second test tube contains 5 mL of crude peroxidase. A 1.0 mL of thymol solution (1 M) was added into each test tube, followed by the addition of 0.1 mL of 30% hydrogen peroxide. The reactions were monitored using TLC analysis. After completion, crude product was extracted using ethyl acetate (2x50 mL). The combined fraction was dried over anhydrous Na_2SO_4. The product was concentrated, and the rest was purified using flash colum chromatography to get the pure dimeric thymol. Structure elucidation of product was performed using GC-MS and FTIR.

Antioxidant Assay

Antioxidant activity of thymol and dimeric thymol was determined using DPPH radical scavenging method. The DPPH radical-scavenging activities were assessed as described previously [39] with major modification. Briefly, 1.0 mL DPPH radical (0.5 mM) was mixed with 1.0 mL of thymol or dimeric thymol solution (in methanol). The volume of the mixture

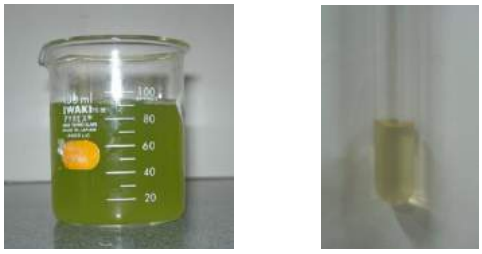
was adjusted to 5 mL by adding methanol. The concentration of thymol were varied from 1, 5 and 15 ppm, and dimeric thymol from 0.25, 0.5 and 1 ppm. The reaction was carried out at room temperature for 25 minutes. The decrease of DPPH radical concentration was monitored every 5 minutes by measuring the absorbance at 517 nm with a UV-Vis spectrophotometer (Shimadzu 2450 double beam). Antioxidant activity was measured as the decrease of DPPH radical concentration caused by the addition of sample (thymol or dimeric thymol), and was expressed as percent inhibition. The value of percent inhibition was calculated by following equation :

$$\% \text{ inhibition} = \frac{A_{\text{control solution}} - A_{\text{sample}}}{A_{\text{control solution}}} \times 100\%$$

Results and Discussion

Isolation and Determination of Specific Activity of Crude Peroxidase

Crude extract of *Brassica juncea* peroxidase has green colour. It signify the presence of impurities such as debris cells from it leaves. Partial purification was performed using gradient concentration of ammonium sulphate at approximately -30°C of environmetal temperature. Result of purification using 30% (by mass) ammonium sulphate solution, called fraction I. Fraction I was then followed by second and third purification stages using 50% and 70% (by mass) of ammonium sulphate, and called enzyme fraction II and III, respectively. Fraction III was used in this experiment in catalyzing oxidative dimerisation of thymol. Before used, determination of total protein content, qualitative analysis and specific activity of fraction III was perfomed and give the following result as described in the next paragraph.



a b

Figure 2. Crude extract of *B. juncea* peroxidase (a) and peroxidase fraction III (b)

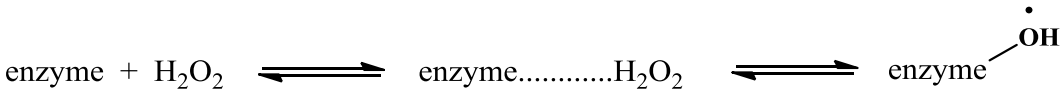
Qualitative analysis using guaiacol shows the positive result. The increase of absorbance at 460 nm (dimeric guaiacol) was recorded. The absorbance increase in the addition of more volume of fraction III peroxidase, as shown in the Table 1

Table 1 : the increase of absorbance at 460 nm in qualitative analysis of enzyme fraction III

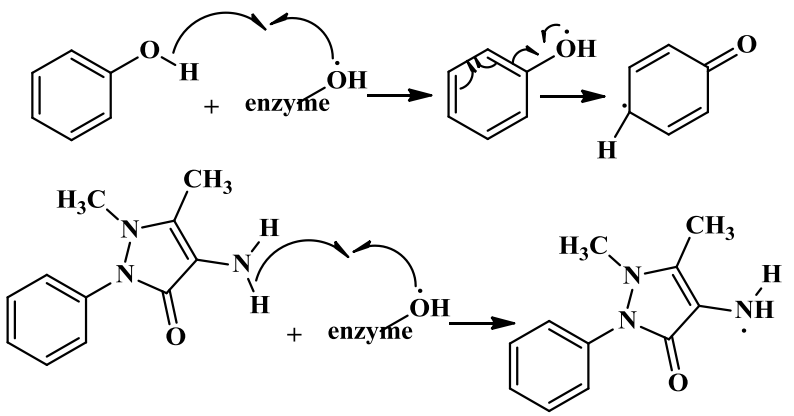
No.	Volume of fraction III (mL)	Volume of guaiacol (mL)	Absorbance at 460 nm
1	1	0.2	1.50
2	2	0.2	1.60
3	4	0.2	3.80

Total protein content of fraction III was determined using Lowry method and was found to be 0.59 mg/mL. As a part in determination of specific activity, peroxidase fraction III reacts with 4-aminoantipyrin (in phenol) which is act as hydrogen donor. This reaction can be observed because there is a change of colour solution to red colour, and monitored at 510 nm using UV-Vis spectrophotometer. the red colour formed is related to the presence of quinoneimine compound. From the quiantification using UV-Vis, absorbance at 510 nm was found to be 2.29. Therefore, by using formula given in experimental section, the specific activity of peroxidase fraction III was found to be 0.59 (unit/mg). The reaction mechanism of enzyme and 4-aminoantipyrin can be illustrated below.

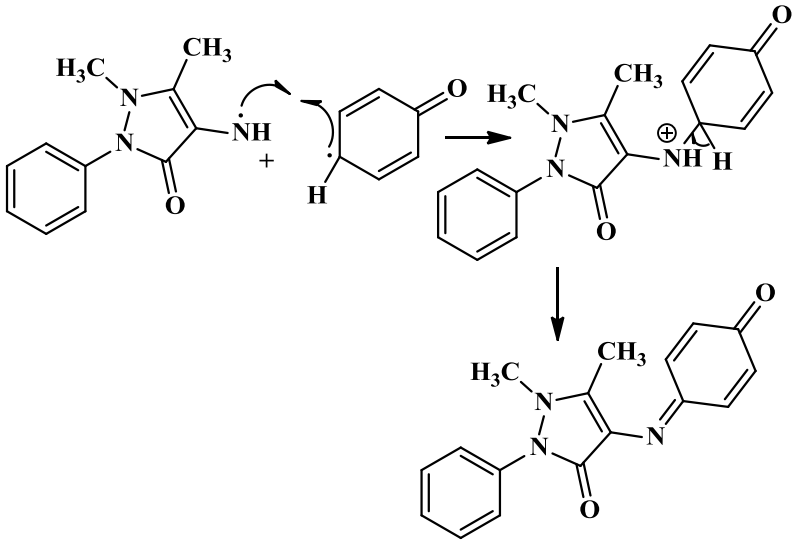
Stage 1 : initiation



Stage 2 : propagation



Stage 3 : termination



Quinoneimine (red)

Figure 3. proposed mechanism in determination of specific activity using 4-aminoantipyrin

Dimerisation of Thymol and Structure Elucidation

We presented a simple and green organic synthesis of dimeric form of thymol via radical C-C oxidative coupling using peroxidase isolated from *Brassica juncea* leaves. The reaction mixture of thymol, hydrogen peroxide and *B. juncea* peroxidase in aqueous medium containing phosphate buffer pH 7.0 was magnetically stirred, and the colour of solution change to orange after 30 minutes reaction time. The completion of the reaction reach after 1.5 hour reaction time. TLC analysis suggested the formation of new compound with higher polarity compared to starting material (thymol) and identified at Rf value of 0.47 (using n-hexane : ethyl acetate 6 : 1 as eluent). The crude product was extracted using ethyl acetate, the solid was purified by column chromatography using silica gel to get the pure desirable product.

Figure 4. Colour change in dimerisation of thymol using *B. juncea* peroxidase

The product was then analyzed using FTIR and GC-MS to confirm the structure of the product. The result of FTIR analysis as summarized in the Table 2. From FTIR analysis, there is no the significant change of IR absorption between thymol and desirable product (dimeric thymol) because both of them has no difference in functional group. We need more chemical instumentation to elucidate the structure of product.

Table 2 : Some of Important IR absorption of thymol and dimeric thymol

No.	**Wavenumber (cm^{-1})**		**Functional group**
	thymol	**dimeric thymol**	
1	3201.0	3418.4	-OH stretch
2	2962.2 ; 2929.7	2958.4 ; 2925.8	C-H sp^3 stretch
3	1619.4	1620.9	Aromatic ring
4	1428.5	1422.4	C-H sp^3 bend
5	1358.5	1379.9	Isopropyl, $-C(CH_3)_2$
6	1159.1	1155.0	C-O single bond stretch
7	733.8	739.2	2 or 3 substituted benzene

From the GC-MS analysis, there are four main peaks with the retention time 15.03 min (m/z 150), 16.64 min (m/z 278), 26.08 (m/z 198), and 28.54 min (m/z 298). The molecular mass analysis, signify that compound which has retention time 15.03 related to thymol structure with Mr 150 g/mol. The fragment with m/z 298 is suggested as dimeric structure of thymol after two thymol radical coupled together. Fragment m/z 298 = 2 x Mr thymol (150) minus two hydrogen atom. Fragment m/z 298 was then followed by some more fragmentation and has several main peaks at m/z 283, 241, 149, 123, 91, and 77 as shown on the picture below. The molecular cation m/z 298 fragmented to m/z 283 by losing one methyl group (-CH_3), molecular cation m/z 298 also fragmented in different pathway to form m/z 241 by losing isopropyl and –CH_2-. The molecular cation fragment m/z 298 was broken in C-C biphenyl bond to give fragment of m/z 149, corresponding to the cationic radical of thymol.

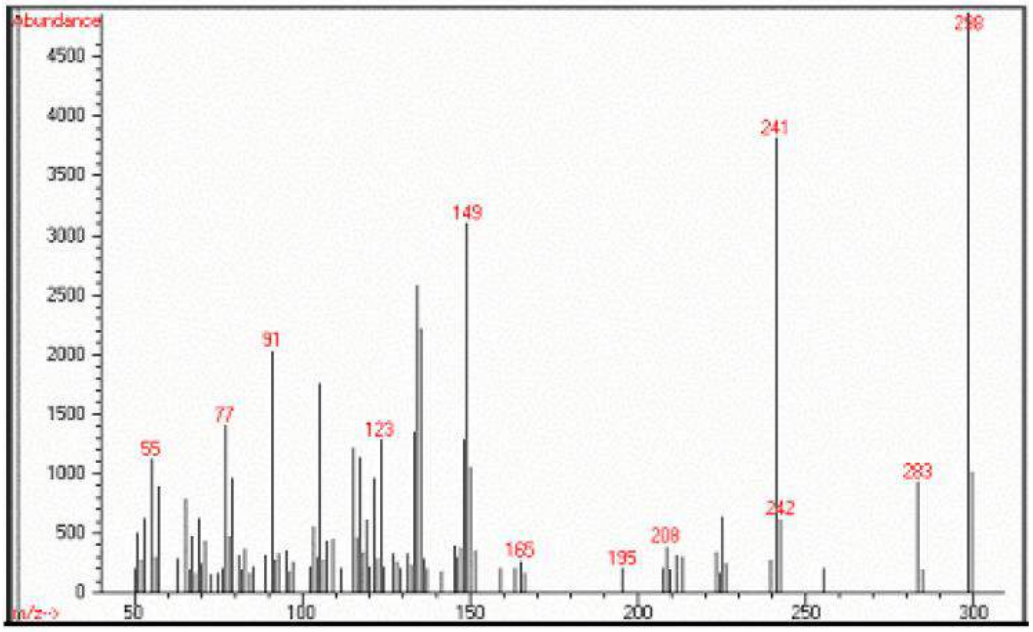


Figure 5. Mass spectra of dimeric thymol

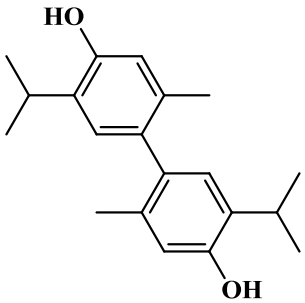


Figure 6. Structure of dimeric thymol

The mechanism of dimeric thymol formation can be described by the following processes. Peroxidase reacts with hydrogen peroxide as acceptor to form oxidized enzyme. Thymol as hydrogen donor give one hydrogen to the enzyme. Therefore, the enzyme is reduced and the thymol is oxidized to thymol radical (phenoxy, in general). Thymol radical stabilize it self by coupling with other thymol radical to form dimeric thymol.

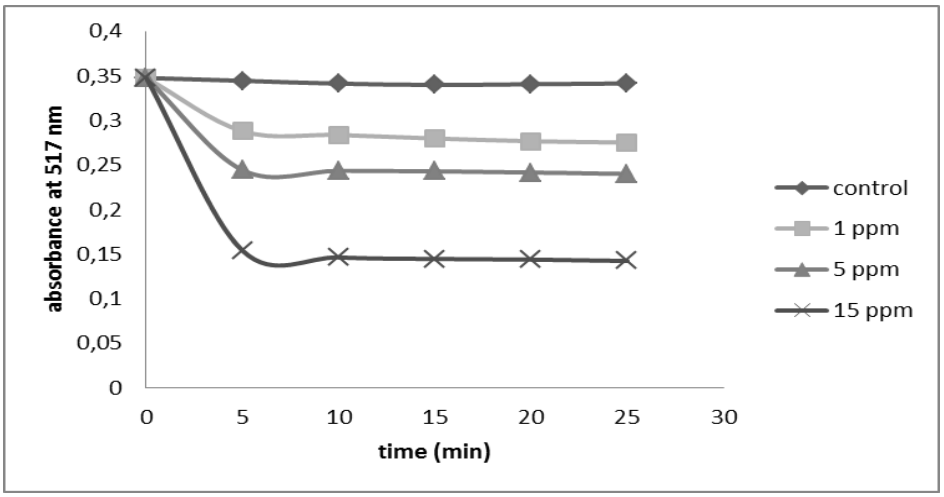
Antioxidant Activity of Thymol and Dimeric Thymol

Phenolics share the same general structure composed of an aromatic hydroxyl nucleus and exist in an approximated number of 8000 in nature. So far, plant phenolics constitute one of major groups of compounds acting as primary antioxidants or free radical terminators [40]. Antioxidant activity is defined as the ability of a compound to inhibit oxidative degradation like lipid peroxidation [40-41]. There are several method in determining of antioxidant activity of certain compound, such as ABTS scavenging activity [42], DMPD assay [43], cupric ion (Cu^{2+}) reducing assay [44-45], chelating activity of ferrous ion (Fe^{2+}) [46], and DPPH assay. The antioxidant activity of dimeric thymol and thymol were evaluated by the neutralizing of DPPH, a model of radical compound [47-48]. In DPPH assay, the antioxidants were able to reduce the stable radical DPPH (violet-coloured) to the yellow-coloured diphenyl-picrylhydrazine. This method is based on the reduction of DPPH in methanolic solution in the presence of a hydrogen-donating compound due to the formation of non-radical form of DPPH. The decrease of radical DPPH absorbance can be monitored quantified at 517 nm. The decrease of DPPH absorbance can be tabulated below.

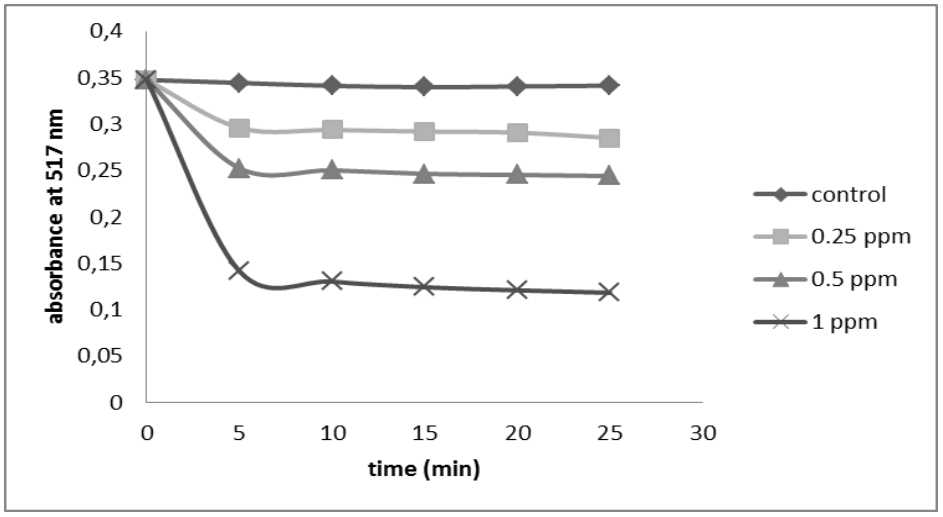
Table 3. The decrease of DPPH absorbance at 517 nm as a function of time

time (min)	**absorbance of DPPH caused by addition of sample**						
	control	**thymol (ppm)**			**dimeric thymol (ppm)**		
		1	**5**	**15**	**0.25**	**0.5**	**1**
0	0.34755	0.34755	0.34755	0.34755	0.34755	0.34755	0.34755
5	0.34440	0.28788	0.24425	0.15400	0.29596	0.25244	0.14162
10	0.34119	0.28363	0.24355	0.14637	0.29370	0.25047	0.13037
15	0.33975	0.27969	0.24291	0.14465	0.29197	0.24641	0.12433
20	0.34051	0.27665	0.24157	0.14388	0.29079	0.24530	0.12100
25	0.34144	0.27511	0.23998	0.14239	0.28154	0.24406	0.11838

Table 3 illustrates a significant decrease in the concentration of DPPH radical due to scavenging ability of dimeric thymol. A 0.5 ppm of dimeric thymol has same ability of 5 ppm of thymol in decreasing the absorbance of DPPH from 0.34755. this indicates the effectiveness of dimeric thymol compared to monomeric of thymol structure, in term of ability in donating hydrogen atom to the radical. IC_{50} values for monomeric and dimeric structure of thymol were found as 12.08 and 0.77 ppm. A lower IC_{50} value indicates a higher DPPH free radical scavenging activity. DPPH scavenging capacity of dimeric thymol 15 times higher monomeric thymol.



a



b

Figure 7. The decrease of DPPH radical absorbance caused by the addition of a sample (a) thymol and (b) dimeric thymol

Table 4. IC_{50} values for monomeric and dimeric thymol

Tested compound	**Antioxidant activity using DPPH method (IC_{50}, ppm)**
Thymol	12.08
Dimeric thymol	0.77

Conclusion

The oxidative coupling dimerisation of thymol was succesfully achieved by using crude extract of *Brassica juncea* peroxidase as edible catalyst in the presence of hydrogen peroxide. Dimeric thymol was identified using GC-MS spectrometry at retention time 28.54 minutes with m/z value of 298. From antioxidant assay, dimeric structure of thymol has greater antioxidant capacity compared to thymol about 15 times. Biocatalytic dimerisation using crude peroxidase from plants provides a new way to synthesis organic molecules with interesting biological performances.

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Salafi Tafsirs: Textualist and Authoritarian?

Izza Rohman[1]

Absract

This essay looks at some Salafi tafsirs to examine the extent to which their interpretation ignores or rejects both the socio-historical context of revelation and that of interpretation, and the extent to which their interpretation denies any possibility to understand the text differently. Taking the ḥijāb verses as a case study, the author shows similarities and differences between the three tafsirs under scrutiny in terms of their "textualism" and "authoritarianism".

Keywords: Salafi tafsir, textualism, authoritarianism, women's issues.

Introduction

In his works, Khaled Abou El Fadl has many times characterized contemporary Wahhabi-Salafis' reading of Islamic (legal) texts as "authoritarian" and "ahistorical" (as well as other attributes he also mentions).[2] His criticism, however, is based on a thorough analysis of the fatwas—many of which are related to the issue of women in Islam—issued by organizations and scholars representing the group—whose discourse to Abou El Fadl has been to a large extent prevalent in many contemporary Muslim societies, even among Muslims in America. The fatwas he examines themselves are far more often based on a certain understanding of hadith, rather than on a particular

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[2] See his books, *Speaking in God's Name: Islamic Law, Authority and Women* (Oxford: Oneworld, 2001) and *And God Knows the Soldier: The Authoritative and Authoritarian in Islamic Discourse* (Maryland: University Press of America, 2001). He defines "authoritarianism" as "the act of 'locking' or captivating the Will of Divine or the will of the text into a specific determination, and then presenting this determination as inevitable, final and conclusive," (*Speaking in God's Name*, 93) or "a hermeneutical methodology that usurps and subjugates the mechanisms of producing meaning from a text to highly subjective and selective reading." (*Speaking in God's Name*, 5). Basically it is an act of closing an open text (the Qur'an), of presenting the text as having a single meaning.

interpretation of the Qur'an. Can thus Abou El Fadl's thesis be applied to Salafis' Qur'anic exegeses? Is an authoritarian and ahistorical kind of interpretation also reflected in their tafsirs?

With regard to Salafis' Qur'anic interpretation in particular, some scholars have come to similar conclusions but in varied terms. Abdullah Saeed has in a few words categorized them as clearly part of "textualism" or "literalism".[3] Following Saeed, but with a broader case of interpretation of Islamic texts, Adis Dudireja concluded that their *manhaj* (method) is "literalist" or at best "semi-contextualist".[4] Similarly, Quintan Wiktorowicz, a political analyst specializing in Wahhabism, characterizes Salafis' approach to the Qur'an as heavily reflecting an "opposition to rationalism"—demonstrated for instance in their interpretation of *āyāt al-ṣifāt* (verses on God's attributes) and *tawḥīd*-related verses.[5] However, while they commonly identify the Salafis as Wahhabis, none of these scholars have analyzed their approach to the Qur'an through a close look at (modern) Salafi tafsirs—which are absent in their bibliographies. To what extent then can Salafi tafsirs be categorized "textualist" or "literalist" and "opposing rationalism"?

This paper seeks to look at Salafis' (i.e. Wahhabis')[6] reading of Islamic

[3]See Abdullah Saeed *Interpreting the Qur'an: Towards a Contemporary Approach* (London & New York: Routledge, 2006), 3. He identifies three broad approaches in relation to Qur'anic interpretation (particularly its ethico-legal content) in the modern world: textualist, semi-textualist and contextualist. In this regard he defines "textualism" as "interpretation that relies on text and tradition *and* at the same time approaches the question of interpretation strictly from a linguistic perspective," and "that ignores or rejects the socio-historical context of the Qur'an in interpretation." (*Interpreting the Qur'an*, 50).

[4]See Adis Dudireja, *Constructing a Religiously Ideal "Believer" and "Woman" in Islam: Neo-traditional Salafi and Progressive Muslims' Methods of Interpretation* (New York: Palgrave Macmillan, 2011), 191-192.

[5]Quintan Wiktorowicz, "Anatomy of the Salafi Movement", *Studies in Conflict & Terrorism* 29 (2006), 207-239.

[6]While the term "Salafi" is not only used in variant meanings by scholars but also contested among those who call themselves Salafis, here the term would be used only to mean the Wahhabis (a term commonly used by non-Salafis or non-Wahhabis but they themselves rarely do so and mostly dislike to do so), particularly the "purists" (who does not form or involve in any local or transnational political movement). The word "salafī" is derived from the word "salaf" which means "predecessor". The term "*al-salaf*" is mostly used to denote the first Muslim generation (until the period of *tābi'ūn* or *tābi' al-tābi'īn*), and is often affixed by the word *ṣāliḥ*; *al-salaf al-ṣāliḥ,* which literally means the "righteous predecessors". The term "Salafi" or "Salafiya" therefore means those who follow the path of *al-salaf al-ṣāliḥ* as model examples. The term "Salafi" is often used by contemporary scholars to only mean the Wahhabis [see for instance Wiktorowicz, "Anatomy of the Salafi Movement"; Saeed, *Interpreting the Qur'an*; and Dudireja, *Constructing a Religiously Ideal "Believer" and "Woman" in Islam*], but is also equally

texts through their Qur'anic exegeses written by three scholars from rather different generations—two of whom surely lived decades earlier than the Salafis to whom Abou El Fadl addresses his critiques. The three Salafi tafsirs involved here are: 1) *Taysīr al-Karīm al-Raḥmān* by 'Abd al-Raḥmān ibn Nāṣir al-Sa'dī (1889-1956),[7] 2) *Aḍwā' al-Bayān* by Muḥammad al-Amīn al-Shinqīṭī (1907-1973),[8] and 3) *Aysar al-Tafāsīr* by Abū Bakr Jābir al-Jazā'irī (1921-).[9] These three tafsirs are arguably the most popular tafsirs written by (modern)

often used to include the Wahhabis and other variants of Salafism [see for instance Abou El Fadl, *And God Knows the Soldier* and *Speaking in God's Name*], and is sometimes used to refer to non-Wahhabi Salafism, either the modernists [see for instance Abou El Fadl, *The Great Theft: Wrestling Islam from the Extremists* (San Francisco: HarperCollins, 2007) and Massimo Campanini, *The Qur'an: The Basics*, translated by Oliver Leaman (London & New York: Routledge, 2007)] or to a much lesser extent the Ikhwanis or similar Islamists. It is important to note that one should not be confused by the term "Salafi" (or "Salafism") in its contemporary usage and the term "Salafiya" (sometimes simply "Salafi" or "Salafism") which is sometimes still used to refer to the earlier movement of the Muslim modernists like Jamal al-Din al-Afghani, Muhammad 'Abduh and Muhammad Rashid Rida. For a brief history (and anatomy) of Wahhabism, see for instance Abou El Fadl, *The Great Theft*, 45-94; and Wiktorowicz, "Anatomy of the Salafi Movement".

[7]Al-Sa'dī was the only Salafi exegete of Saudi origin among the three scholars discussed here. He was born and buried in 'Unayzah in the Qasim Province of Saudi Arabia. He was among the influential teachers of Muḥammad ibn Ṣāliḥ al-'Uthaymin (1925-2001), one of the most influential Salafi scholars who reportedly delivered lectures in the Masjid al-Haram, Mecca, for over thirty five years. *Taysīr al-Karīm al-Raḥmān* is said to be the most famous among not less than a dozen of his works. For his brief biography, see his tafsir, *Taysīr al-Karīm al-Raḥmān fī Tafsīr Kalām al-Mannān* (Cairo: Dār al-Ḥadīth, 2005), 11-13.

[8]Al-Shinqiti (not to be confused by another al-Shinqīṭī who was the teacher of al-Sa'dī or other equally prominent scholars named al-Shinqīṭī) was a Mauritanian scholar but later resided in Saudi after performing *ḥajj* in 1367 AH. He reportedly completed teaching tafsir in Masjid al-Nabawi twice. Initially a follower of Maliki madhhab, he was the teacher of some of the most influential Salafi figures like the former mufti of Saudi, 'Abd al-'Azīz Bin Bāz (1909-1999), and a radical figure, Ḥammūd al-'Uqlā al-Shu'aybī (1925-2002)—who was also said to be one of Abū Bakr al-Jazā'irī's teacher. See for instance Wiktorowicz, "Anatomy of the Salafi Movement", 236. In *Aḍwā' al-Bayān*, his masterpiece, al-Shinqīṭī himself does not interpret the whole of the Qur'an, but he finishes at al-Mujādalah [58]: 22. The rest included in the last two volumes was done by his disciple, 'Atiyah Muhammad Salim, with Bin Bāz's encouragement. For al-Shinqīṭī's short biography, see his tafsir, *Aḍwā' al-Bayān fī Īḍāḥ al-Qur'ān bi al-Qur'ān* (Beirut: Dār Iḥyā' al-Turāth al-'Arabī, n.d.), vol. 1, 9-26.

[9]Al-Jazā'irī was an Algerian scholar who later resided in Saudi. A prolific scholar, al-Jaza'iri was initially well-known for his *Minhāj al-Muslim*, which has been translated into many languages—Urdu, French and Indonesian among others. *Aysar al-Tafāsīr* is among his latest works and the most voluminous.

Salafi scholars.[10] Their popularity among Salafis themselves is perhaps only exceeded by such tradition-based tafsirs as *Tafsīr al-Qur'ān al-'Aẓīm* by Ibn Kathīr (which follows the principles and methods of tafsir outlined by his teacher, Ibn Taymīyah, a figure labeled as a "salafi par excellence")[11] and *Jāmi' al-Bayān* by Ibn Jarīr al-Ṭabarī (a tafsir Ibn Taymīyah recommends most).[12]

In addition to revealing some of the characteristics of Salafis' approach to the Qur'an embodied in these three tafsirs, I will—for the purpose of this study—take the case of the interpretation of Qur'anic ethico-legal verses related to women's issues, particularly two interrelated issues of the rule of gazing at "unrelated" women (*al-naẓar ilā al-ajnabīyah*) and the segregation (*'adam al-ikhtilāṭ*) between male adults and female adults. The choice to limit this to women's issues is partly because the so-called Wahhabis has often been regarded as imposing harsh restrictions on women, and also because Abou El Fadl and Dudireja have come to the conclusion this study wants to verify, that the Salafi/Wahhabi approach is largely "authoritarian" and "literalist/textualist", mainly based on an examination of the fatwas or Salafi scholars' views regarding women's issues. My choice to focus on the issues of gazing at the *ajnabīyah* and gender segregation is primarily due to the fact that these are among a number of issues where strict rules on them are very often ascribed to Salafis—though some of the traditionalists, another group which is also considered a proponent of textualism, might also advocate similarly rigid stances. While so-called traditionalists are considered to deal with the issues in a less rigid manner, Salafis—who are initially more distinctive in terms of their *'aqīdah* rather than in terms of their *fiqh*—are repeatedly said to insist on strict rulings on (seeing) women's *'awrah* (part of their body which should be covered which, according to Salafis, happens to be their whole body except for the eyes or even one of the eyes) and strict male-female segregation.[13]

Their standpoints on both issues are often justified by a certain

[10]There is another contemporary Salafi tafsir written by a popular figure, 'Ā'iḍ al-Qarnī entitled, *al-Tafsīr al-Muyassar* (Riyad: al-'Ubaykan, 2007) but this tafsir is too concise to be included in my analysis.

[11]See Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm* (Mu'assasah Qurṭūbah, n.d.), 6-19.

[12]See Ibn Taymīyah, *Muqaddimah fī Uṣūl al-Tafsīr* (Beirut: Dār Ibn Ḥazm, 1997), 110.

[13]This assumption seemingly needs further clarification since strict gender segregation and rigid rules on female *'awrah* might extend Salafi and non-Salafi boundaries. See its indication for instance in Muḥammad 'Alī al-Ṣābūnī, *Tafsīr Āyāt al-Aḥkām min al-Qur'ān* (Beirut: Dār al-Kutub al-'Ilmīyah, 1999), vol. 2, 109-112, 254. However, here it suffices to say that Salafis are among renowned advocates of strict legal rulings on these matters.

understanding of the "*āyāt al-ḥijāb wa al-naẓar*" (verses on partition and gazing), i.e. al-Nūr [24]: 30-31 and al-Aḥzāb [33]: 53 (sometimes also 59). Therefore, here I will focus (though not exclusively) on how these verses are interpreted in the three tafsirs under scrutiny. In analyzing their interpretation, I will mainly employ two criteria derived respectively from Saeed's definition of textualism and Abou El Fadl's definition of authoritarianism,[14] namely: 1) the extent to which an interpretation ignores or rejects both the socio-historical context of revelation and that of interpretation, and 2) the extent to which an interpretation "closes the open text", meaning that it denies any possibility to understand the text differently and implies that the text means only "Y" though it has been understood by others to mean "X" or "Z". This in some way means that here I will chiefly focus on the Salafi exegetes' treatment of the "textuality" of the Qur'an and their treatment of differences in interpretation.

By doing so, I am at risk of merely imposing an outsiders' perspective on Salafi tafsirs. Therefore, in an effort to be more balanced, I will seek to address the problem of ignorance/attentiveness of the context of the Qur'an and the problem of authoritarian/authoritative interpretation through what I consider as their relevant principles of interpretation so as to understand a certain way of thinking which might lie behind their textual/contextual and authoritarian/authoritative approach to the Qur'an. Accordingly, before discussing their interpretation on "*ḥijāb* verses", a methodological review of the three tafsirs will be outlined below to shed light on the nature of Salafi hermeneutics, particularly in connection with Salafis' views on the "context" of the Qur'an and the "plurality of interpretation".

Taysīr al-Karīm al-Raḥmān, *Aḍwā' al-Bayān*, *Aysar al-Tafāsīr* and Salafi Approaches to the Qur'an

It might have been often assumed that Salafis generally give preferentiality to the style of what so-called *tafsīr bi al-ma'thūr/tafsīr bi al-riwāyah* ("tradition-based Qur'an exegesis")—mainly because it is presumably far from innovations (*bida'*), rather than that of *tafsīr bi al-ra'y/tafsīr bi al-dirāyah* ("reason based Qur'an exegesis"). However, this assumption seems to be not totally correct. Among the three Salafi tafsirs, only *Aḍwā' al-Bayān*, a six-volume tafsir,[15] can be undoubtedly classified a *tafsīr bi al-ma'thūr*, especially one that generally follows the steps recommended by Ibn Taymīyah

[14]See the definitions in footnote 1 and 2.

[15]It is the edition printed by Dār Iḥyā' al-Turāth al-'Arabī, Beirut. *Aḍwā'* was previously printed in nine volumes by Dār 'Ālam al-Fawā'id, Mecca.

and Ibn Kathīr.[16] Quite the opposite, *Taysīr al-Karīm al-Raḥmān*, a one thousand and more-page tafsir,[17] and *Aysar al-Tafāsīr*, a six-volume tafsir, are more similar to *tafsīr bi al-ra'y* in style, the former being comparable to *Tafsīr al-Jalālayn* by Jalāl al-Dīn al-Maḥallī and Jalāl al-Dīn al-Suyūṭī as well as two much shorter contemporary tafsirs, *al-Tafsīr al-Wajīz* by Wahbah al-Zuḥaylī and *al-Tafsīr al-Muyassar* by another Salafi author 'Ā'iḍ al-Qarnī, while the latter being to some extent comparable to *Tafsīr al-Marāghī* by Aḥmad Muṣṭafā al-Marāghī but shorter. Of course, Salafis are among Muslims who strongly insist on the need to avoid *ra'y* (baseless personal opinion) in interpreting the Qur'an, and even consider tafsir with pure *ra'y* illegitimate, but if one defines *tafsīr bi al-ra'y* as the one that does not display *riwāyāt* (narrations) in the interpretation, then both *Taysīr* and *Aysar* can be categorized so. Nonetheless, it is inaccurate to say that al-Sa'dī and al-Jazā'irī very much employ rational thinking in interpreting the Qur'an.

While al-Sa'dī's *Taysīr* is best described as a *tafsīr ijmālī* ("concise sequential commentary")[18] and al-Shinqīṭī's *Aḍwā'* is clearly a *tafsīr taḥlīlī* ("analytical sequential tafsir"), al-Jazā'irī's *Aysar* is somewhere in between. Therefore, *Taysīr* and *Aysar* to a lesser extent, seem to reflect more a premise Salafis hold that the messages of the Qur'an are clear enough, and that understanding the Qur'an is not really a complicated problem—which for one thing implies that there is no need for long-winded interpretation (*iṭnāb* or *taṭwīl*). Both tafsirs represent a broader modern trend of providing a "made-easy" and "made-simple" (*sahl muyassar*) tafsir.[19] This "selling-point" is implied in the titles of both and clearly stated in the introductions to each.[20] Given the way Salafis see the clarity of Qur'anic messages, some scholars like Wiktorowicz have even suggested that for Salafis, "there is really no such thing

[16]That is to find explanation (tafsir) firstly from the Qur'an, then from hadith, and then from the opinions of the companions of the Prophet and then from the opinions of the successors (*tābi'un*). See Ibn Taymīyah, *Muqaddimah fī Uṣūl al-Tafsīr*, 84-109, his *al-Tafsīr al-Kabīr* (Beirut: Dār al-Kutub al-'Ilmīyah, n.d.), vol. 2, 231-244, and Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm*, 6-19.

[17]It is reported (in the introduction to the book) that it was once printed in five volumes.

[18]See for instance Fahd ibn 'Abd al-Raḥmān al-Rūmī, *Buḥūth fī Uṣūl al-Tafsīr wa Manāhijihi* (Maktabat al-Tawbah, n.d.), 59-60.

[19]Other tafsirs within this trend include al-Qarnī's *al-Tafsīr al-Muyassar*, al-Zuḥaylī's *al-Tafsīr al-Wajīz* and 'Alī al-Ṣābūnī's *Ṣafwat al-Tafāsīr*.

[20]See introductions to *Taysīr* by 'Abd Allāh ibn 'Abd al-'Azīz ibn 'Aqīl and Muḥammad al-Ṣāliḥ al-'Uthaymin in *Taysīr*, 5-7; and al-Jazā'irī's introduction to his *Aysar al-Tafāsīr li Kalām al-'Alīy al-Kabīr* (Medina: Maktabat al-'Ulūm wa al-Ḥikam, 2003), vol. 1, 4-6.

as interpretation".[21]

On the other hand, *Aḍwā'* is more similar to many of the voluminous classical tafsirs in which extended discussions on certain topics—as well as quotations of *sha'ā'ir* or *shawāhid 'arābīyah* (Arabic poems)—might sometimes interrupt the author's interpretation. Nevertheless, among the three, *Aḍwā'* is perhaps the best example of a Salafi tafsir built on the premise that the Qur'an is self-explanatory—a premise that Salafis also strongly hold. While it largely follows the tradition of interpretive methodology endorsed by Ibn Taymiyah, *Aḍwā'* is quite different from the tafsirs of Ibn Kathīr or Ibn Qayyim (two prominent disciples of Ibn Taymīyah) in that it is mostly based on an intensive application of the methodology of interpreting the Qur'an by the Qur'an itself, rather than heavily relying on hadith like Ibn Kathīr's tafsir. *Aḍwā'* is even arguably one of the most intensive tafsirs in terms of the application of cross-referential hermeneutics.[22]

The three Salafi authors, however, unanimously follow the spirit of Ibn Taymīyah's "anti-*ta'wīl*" when dealing with "ambiguous verses" (*āyāt mutashābihāt*).[23] Al-Jazā'irī states in his introduction to his tafsir that it follows *manhaj al-salaf* when interpreting verses related to *'aqīdah* and *asmā' wa al-ṣifāt*.[24] Muḥammad al-'Uthaymin says the same with regard to al-Sa'dī's tafsir.[25] Al-Shinqīṭī himself wrote a book arguing against the existence of *majāz* ("allegorical/metaphorical" expressions) in the Qur'an, *Man' Jawāz al-Majāz fī al-Munazzal li al-Ta'abbud wa al-I'jāz*, which is attached in the last volume of *Aḍwā'*.[26] This "anti-*ta'wīl*" attitude is reflected for instance in their interpretation (or rather: lack of interpretation) of *al-ḥurūf al-muqaṭṭa'ah*

[21]Wiktorowicz, "Anatomy", 210. For a comparable statement see Dudireja, *Constructing a Religiously Ideal*, 191.

[22]My preliminary research comparing his tafsirs with other tafsirs known for their serious attention to *tafsīr al-Qur'ān bi al-Qur'ān* reveal that *Aḍwā'* is the most focused in citing relevant verses in other parts of the Qur'an while interpreting a certain word, verse or group of verses. Taking the case of suras al-Fātiḥah and Qāf as samples, *Aḍwā'* cites on average 8.9 times on each page, while al-Rāzī's *Mafātīḥ al-Ghayb* cites 3.4 times/page, al-Qāsimī's *Maḥāsin al-Ta'wīl* cites 1.8 times/page, Ibn Kathīr's *Tafsīr al-Qur'ān al-'Aẓīm* cites 1.7 times/page, and al-Ṭabāṭabā'ī's *al-Mīzān* cites 1.3 times/page.

[23]For the discussions on how al-Sa'dī and al-Shinqīṭī interpret *āyāt al-ṣifāt*, read Muḥammad ibn 'Abd al-Raḥmān al-Mighrāwī, *al-Mufassirūn bayna al-Ta'wīl wa al-Ithbāt fī Āyāt al-Ṣifāt* (Beirut: Mu'assasat al-Risālah, 2000), 694-705.

[24]Al-Jazā'irī, *Aysar al-Tafāsīr*, vol. 1, 6.

[25]Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 7.

[26]See al-Shinqīṭī, *Aḍwā' al-Bayān*, vol 6, 389-410. The belief whether or not *majāz* exists in the Qur'an surely affect the way exegetes interpret *ṣifāt*-related verses.

(initial letters in the beginning of suras).[27]

While for Salafis following the *manhaj* is of utmost importance to avoiding any misunderstanding of what God means, for critics it would mean a blunt opposition to rationalism. They have argued that Salafis adhere to the text to a point where they consider the application of human intellect and logic (rationalism) to the Qur'an to be dangerous. "Any time humans attempt to apply their own logic or methods of reasoning … they open the way to human desire, distortion, and deviancy. Approaches that are guided by human logic will necessarily fall foul of human desire, which will lead to the selective and biased extrapolation of religious evidence to support human interests rather than religious truth."[28]

In addition to their similarities in their treatment of *'aqīdah* verses, to a certain degree the three tafsirs are equally concerned with *aḥkām* verses. Al-Shinqīṭī himself states that one of his objectives in *Aḍwā'* is to provide explanations of *āyāt al-aḥkām* in the Qur'an. A close look at *Taysīr* and *Aysar* will reveal a similar conclusion. With regard to *Aysar*, it is understandable that one of al-Jazā'irī's aims is for the readers to focus more on how to implement the Qur'an.[29]

Nevertheless, when addressing differences of opinion/interpretation, the three tafsirs have different attitudes. While *Aysar* and *Taysīr* consciously avoid mentioning *ikhtilāf* among exegetes, *Aḍwā'* frequently mentions different opinions, particularly with regard to *āyāt al-aḥkām*—though the author seems to always mention what he regards as the strongest of opinions. For the authors of *Aysar* and *Taysīr*, the intentional avoidance of mentioning differences in

[27]Al-Sa'dī simply mentions that the safest is "*al-sukūt*" (silencing) what it might mean and be sure that there exists a *ḥikmah* (wisdom) we do not know, or simply mentions that no one knows its meaning except for Allah, or simply makes no comments on those letters. Similarly, al-Jazā'irī simply suggests that such letters are a part of *mutashābih* of which only God who knows its meaning, or simply mentions that the *salaf's* school regarding such letters is to say, "God knows its intended meaning." In the case of *ṭāhā* (Ṭāhā [20]: 1), however, al-Jazā'irī—following al-Ṭabarī—says that it means "O man", an opinion that is disapproved by al-Shinqīṭī. Al-Shinqīṭī himself rarely gives any comment on those letters, but explains his preference while interpreting Hūd [11]: 1. Implementing the method of *istiqrā' al-Qur'ān*, he follows the conclusion of al-Rāzī, Ibn Kathīr and Ibn Qayyim al-Jawzīyah that such letters are an indication that the subsequent discussion in a sura, where those letters are mentioned, deals with the inimitability (*i'jāz*) of the Qur'an. See al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 2, 5-7. The function of these letters as a sign of *i'jāz* has been discussed in more detail by 'Ā'isha Bint al-Shāti' in her *al-I'jāz al-Bayānī li al-Qur'ān* and *al-Tafsīr al-Bayānī li al-Qur'ān al-Karīm*.

[28]Wiktorowicz, "Anatomy", 210.

[29]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6.

interpretation (*ighfāl al-khilāfāt al-tafsīrīyah* in al-Jazā'irī's term or *tajannub dhikr al-khilāf* in al-'Uthaymin's word while introducing al-Sa'dī's tafsir) is another "selling-point" of both tafsirs, and seems to have something to do with the perceived need for "uniting Muslims in a unified, correct and good Islamic thinking" (*jam' al-muslimīn 'alā fikr islāmī muwaḥḥid ṣā'ib salīm*).[30] For Salafis, what is considered "correct" when looking at differences of interpretation is usually the one that is exemplified by exegetes among the Companions or the Successors—whom they call *jumhūr al-mufassirīn min al-salaf al-ṣāliḥ*. In the case of al-Jazā'irī, the "selected" opinion from existing different interpretations is usually, as he himself states, relied upon al-Ṭabarī's preference.[31]

It might often be argued that in terms of the truth one can achieve through interpretation, Salafis view that there is an objective meaning that we can take hold of, and there is only one legitimate religious interpretation. It has also been argued that for Salafis Islamic pluralism does not exist, and if it seems exist, it should be avoided.[32] In critics' words, Salafis approach the authoritative text to a point that they identify with and represent the text or the singular truth revealed by the text; they consider their understanding as the only "correct" one and reject any possible meaning other than their understanding. However, if one looks at al-Shinqīṭī's tafsir in particular, this perceived single legitimate, objective interpretation is achieved in a more argumentative manner. Al-Shinqīṭī heavily relies on what the Qur'an tells in other verses to determine what is intended by a certain word or phrase in a particular verse. His manner of interpretation is perhaps more "textualist" but less "authoritarian". Meanwhile in the case of al-Jazā'irī's tafsir, this "single legitimate" is achieved through reliance on a selected "authoritative" *salaf*. In the name of practicality and the unity of *umma*, he transforms what the critics would consider as an "un-authoritarian" way of interpretation into what they would consider as an "authoritarian" way of interpretation, a negligence of multiple understandings and the complexity of meaning. If his interpretation is to be considered "authoritarian", one can now learn how such an "authoritarian" reading is constructed through not only a historical leap, but also a selective manner—limiting to one among different *salaf*'s interpretations—which they regard mainly contain *ikhtilāf tanawwu'* (corresponding difference), and not *ikthilāf*

[30]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6. Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 7.
[31]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 1, 6.
[32]See for instance Wiktorowicz, "Anatomy", 207.

taḍād (contradictory difference).[33]

Hermeneutics in the three tafsirs is largely "text-centered", rather than "reader-centered", and "language-oriented" rather than "discourse-oriented".[34] In their text-centered hermeneutics, remains a very limited attention to the socio-historical context of the Qur'an—as is the case with many tafsirs. Apart from mentioning *asbāb al-nuzūl*, there is hardly any reference both to the past and present contexts. This "textualist" tendency can to some extent be attributed to the principles tafsirs Salafis consider to be important in order not to misunderstand what the Qur'an means. Al-Sa'dī's method of interpretation itself is noticeably based on the principles—many of which deal with deriving "general" Qur'anic rulings with linguistic analysis—outlined by Ibn Qayyim which readers can read in the beginning, and is partly summarized at the end of al-Sa'dī's book.[35] A notable emphasis on the "generality/universality" of the text is also apparent in al-Shinqīṭī's tafsir—and that of al-Jazā'irī as well except that the latter is often satisfied with simply following the conclusion of al-Ṭabarī while al-Shinqīṭī focuses more on the application of his own interpretive methodology.

The Rulings on Gazing at Women and Male-Female Segregation in Salafi Tafsirs

The three tafsirs under discussions by and large come to the same conclusion regarding these two issues: 1) that gazing at any part of the *ajnabīyah's* body is forbidden, and 2) that there should be no free mixing (*ikhtilāṭ*) between male and female. Their argument principally is this: free mixing is prohibited since gazing at a woman (as well as talking to a woman face to face) is prohibited, and gazing at a woman is prohibited since all parts of her body (except for her eyes) are considered *'awrah* (private part/shame of sex) which should remain veiled; and gazing at *'awrah* is prohibited since gazing might results in "dirt heart/a dirty heart", "lust" (*shahwah*) and even "adultery" (*zinā*).[36]

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[33]How Salafis see differences among *salafs* is very much influenced by this distinction made by Ibn Taymīyah between *ikhtilāf tanawwu'* and *ikhtilāf taḍād*. See his *Muqaddimah fī Uṣūl al-Tafsīr*, 36; *Iqtiḍā' al-Ṣirāt al-Mustaqīm Mukhālafat Aṣḥāb al-Jaḥīm* (al-Majd al-Tijārīyah, n.d.), 37-39; and *al-Tafsīr al-Kabīr*, vol. 2, 196.

[34]For this distinction between "language" and "discourse" derived from the linguist and literary theorist Tzvetan Todorov, see Saeed, *Interpreting the Qur'an*, 106-107.

[35]See al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 14-20, 1043-1046.

[36]Both the conclusion and argument are not actually uncommon among Muslim exegetes. See some comparable conclusions and arguments (but sometimes with minor

Even though our focus here is on the way they interpret the *ḥijāb* verses, rather than on the conclusion they make itself, here one would pay attention to their steps to come to the conclusion while interpreting the verses. There are some terms or concepts in al-Nūr [24]: 30-31 and al-Aḥzāb [33]: 53 which are understood as implying that for a male adult (*mumayyiz*), seeing an "unrelated" woman (particularly whose *'awrah* is not totally masked) is forbidden, and that there should be a "veil/curtain" between male and female adults: 1) *ghaḍḍ al-baṣar* (lowering gaze/casting down eyes), 2) *ibdā' al-zīnah* (displaying/showing off adornments), and 3) *(mukhāṭabah) min warā' ḥijāb* (talking from behind a curtain/screen).

As it might be predicted, given their conciseness and tendency to consciously display only one interpretation, even when dealing with differences, *Taysīr* and *Aysar* are more straightforward in highlighting these "clear" instructions in the verses. The author of *Taysīr* understands the first instruction (*ghaḍḍ al-baṣar*) as casting down one's eyes from looking at the *'awrah* and "unrelated" men or women with lust or from similar forbidden looks.[37] He then proceeds with what is meant by *al-zīnah* which for him includes clothes, jewels and all parts of a woman's body, and by the exception in the verse (understood from the phrase *illā mā ẓahara minhā*) which means "their visible clothes". The understanding of *al-zīnah* as including all parts of a woman's body, to al-Sa'dī, is indicated by the sequential instruction of *iḍrāb al-khumūr 'alā al-juyūb* (drawing the veils/headcovers over the bosom). And with regard to talking to a woman *min warā' ḥijāb*, he understands it as implying that looking at a woman is forbidden (*mamnū'*) in any situation (*bi kull ḥāl*). He then explains that the *ḥikmah* of this instruction mentioned in the phrase *dhālikum aṭhar li qulūbikum wa qulūbihinna* (that is purer for your hearts and their hearts) indicates a principle of sharia that *jamī' wasā'il al-sharr wa asbābuhu wa muqadimmātuhu mamnū'ah* (any means, cause and preliminary of wrongdoing is prohibited).

In interpreting these verses, as is the case with the majority of Qur'anic verses, the author of *Taysīr* neither displays any linguistic analysis, mentions any hadith (*riwāyah*) to support his conclusion, quotes any other relevant verses, mentions a principle of *uṣūl al-fiqh* or *uṣūl al-tafsīr*, discusses different socio-cultural contexts, nor mentions any different opinions. This is also the case with the author of *Aysar*—except that he mentions the occasions of

difference in terms of the limits of *'awrah*) in Muḥammad ibn Aḥmad al-Anṣārī al-Qurṭūbī, *al-Jāmi' li Aḥkām al-Qur'ān* (Cairo: Dār al-Ḥadīth, 2002), vol. 6, 513-519; 'Alī al-Ṣābūnī, *Tafsīr Āyāt al-Aḥkām*, vol. 2, 109-115, 254.

[37] Al-Sa'dī, *Taysīr al-Karīm al-Raḥmān*, 615.

revelation (*asbāb nuzūl*) in interpreting 33: 53.[38]

Compared to al-Sa'dī, al-Jazā'irī however at one point has a different understanding of *ibdā' al-zīnah* which means to him revealing parts of a women's body which serve as places of jewelry (*mawāḍi' al-zīnah*), and of the exception, *illā mā ẓahara minhā,* as the one that could not surely be hidden like eyes, palms or clothes. While interpreting the *jilbāb* verse, 33: 59, he goes further to briefly mention that today there is even no need for not covering eyes, since a woman can use a thin layer (*qumāsh raqīq*) to veil her eyes and at the same time can still look at the street she is passing along.[39] In addition, he firmly stresses that 33: 53 in part explains that a man would have a certain degree of "wicked imagination" (*khawāṭir al-sū'*) when talking to and looking at a woman.[40]

On the other hand, the author of *Aḍwā'* does many of the things that the authors of *Taysīr* and *Aysar* do not do. He slightly discusses a linguistic problem by quoting classical exegetes like al-Zamakhsharī and al-Qurṭūbī, as well as quoting some relevant *shi'rs*. He discusses some seemingly contradictory hadiths relevant to understanding of the verses. He mentions many relevant verses useful to better understand the verse under discussion. He mentions some principles of *uṣūl al-tafsīr*. Above all, he mentions different interpretations and subsequently argues against some of the interpretations, but finally declares that *wa Allāh ta'ālā a'lam* (God the Exalted knows best).

While interpreting sura 24: 31,[41] al-Shinqīṭī sums up the different interpretations of *zīnah* into three viewpoints: 1) that it means parts of a woman's body, 2) that it means ornaments/jewels a woman uses for her beauty which do not necessarily require a part of her body to be revealed, 3) that it means ornaments a woman uses for her beauty which necessarily require a part of her body to be revealed.[42]

Al-Shinqīṭī then proceeds with quotations from Ibn Kathīr, al-Qurṭūbī, al-Zamakhsharī and al-Suyūṭī (who mention interpretations of earlier generations) before once again asserting that the differences among *salaf* can be summarized in those three categories, and that for him the second (that *zīnah*

[38]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 287, 291.
[39]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 292.
[40]Al-Jaza'iri, *Aysar al-Tafāsīr*, vol. 4, 289.
[41]Al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 4, 95-104.
[42]Al-Jazā'irī's position would fit the last, while al-Sa'dī's stance is more a combination between the first and the second. Al-Jazā'irī's position in this case is a bit different from al-Ṭabarī (the exegete he often relies on) who prefer the opinion that the exception of *zīnah* refers to the palms and the face. See Ibn Jarīr al-Ṭabarī, *Jāmi' al-Bayān fī Ta'wīl al-Qur'ān* (Beirut: Dār al-Kutub al-'Ilmīyah, 2005), vol. 9, 306.

means something outside her body [*khilqah*] which does not necessarily require a part of a woman's body be seen) which implies that *mā ẓahara minhā* means her clothes, is the clearest and most careful stand.[43]

Al-Shinqīṭī then mentions some principles of tafsir (he often uses in his tafsir) which support his argument, namely the identification of *qarīnah fī nafs al-āyah* (evidence in the same verse) and the identification of the most usual intended meaning of the word in the Qur'an (*al-murād min al-lafẓ fī al-ghālib*) to see whether an interpretation is appropriate—two principles that he also uses in interpreting the *ḥijāb* verse in al-Aḥzāb. Implementing both principles, al-Shinqīṭī argues that the first opinion is invalid. The choice is thus now only between the second and the third.

Al-Shinqīṭī then uses the principle of "carefulness" (*iḥtiyāṭ*) to weigh the second over the third. The second, he argues, is farther from the *'illah* (underlying reason) of the prohibition of gazing at a woman (i.e. *fitna* and *ṭuhūr al-qalb*) and thereby more preventive from any disallowed occurrence.

Moreover, again arguing against the first and the third opinions, al-Shinqīṭī asserts the poor quality of a hadith indicating that a woman's *'awrah* excludes her face and palm.

While interpreting 33: 53,[44] al-Shinqiti also uses the two abovementioned principles of tafsir to argue against those who consider that the instruction of talking *min warā' ḥijāb* only applies to the Prophet's wives. The reasoning (*ta'līl*) mentioned in the verse (*dhālikum aṭhar liqulūbihim wa qulūbihinna*) is universal/general and thereby the *ḥukm* (ruling) is also universal/general. He argues that this principle, that the generality of *'illah* means the generality of *ḥukm*, is already well-known in *uṣūl al-fiqh*.

Al-Shinqīṭī further supports his argument with other relevant Qur'anic verses (33: 59, 60 and 24: 31). He explains how these verses support his argument and argues against those who interpret these quoted verses differently. He supports the authoritativeness of his interpretation with that of exegetes among the Companions—who relate the verse with its *sabab nuzūl*—as well as linguistic argumentation.

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[43]It should be noted that al-Shinqīṭī's stand on the meaning of *zīnah* is different from that of al-Qurṭūbī (an exegete from whom he quotes some narrations) and earlier narration-minded exegetes like al-Ṭabarī (as mentioned in the previous footnote). His view is also a bit different from, but closer to, that of al-Zamakhsharī. See al-Qurṭūbī, *al-Jāmi' li Aḥkām al-Qur'ān*, vol. 6, 519; Abū al-Qāsim Maḥmūd al-Zamakhsharī, *al-Kashshāf 'an Ḥaqā'iq Ghawāmiḍ al-Tanzīl wa 'Uyūn al-Aqāwīl fī Wujūh al-Ta'wīl* (Riyad: Maktabah al-'Ubaykān, 1998), vol. 4, 289-291.

[44]Al-Shinqīṭī, *Aḍwā' al-Bayān*, vol. 4, 287-297.

Again he asserts another similar principle of *uṣūl* which supports the generality of the *ḥijāb* instruction, namely that *khiṭāb al-wāḥid ya'ummu ḥukmuhu jamī' al-ummah, wa lā yakhtaṣṣu al-ḥukm bi dhālika al-mukhāṭab al-wāḥid*, and stresses the soundness of this principle.

He then argues against those who support the specificity of the *ḥijāb* instruction only to the Prophet's wives by employing a logic: if it was only for the Prophet's wives, they surely are good examples (*uswah*) for all Muslim women.[45]

Subsequently al-Shinqīṭī mentions and discusses some hadiths (and quotes their interpretations by Ibn Ḥajar) which support the generality of the instruction as well as supporting the interpretation of *iḍrāb al-khumūr 'alā al-juyūb* as veiling the face. He then feels the need to briefly assert the position of hadith as the *mubayyin* of the Qur'an by quoting a relevant verse. Next he expresses his amazement with those who say that there is neither Qur'anic verse nor hadith which show the obligation for women to veil their face in the presence of "unrelated" men (*ajānib*).

Later al-Shinqīṭī cites some hadiths, stating that a woman is *'awrah,* which support the obligation of *ḥijāb* and discusses some hadiths used by those who argue for the permissibility of women to unveil their face and palms in the presence of the *ajānib.* He shows the poor quality of these hadiths, or otherwise, clarifying that the hadiths seemingly indicating that women did not veil their face during the Prophet's time do not really point out that they unveil their face intentionally.

Finally, de-legitimizing other interpretations, al-Shinqīṭī concludes that God (*al-Shāri'*) prohibits women from unveiling their face before the *ajānib*, since the face is *aṣl al-jamāl* (the source of beauty) and looking at a young beautiful woman's face is a threshold into seduced human desire (*gharīzah basharīyah*) and might lead to unexpected occurrences. Al-Shinqīṭī goes further to briefly explain relevant topics—shaking hands with a woman and touching her body, both of which are not allowed.

Even though al-Shinqīṭī arrives at a dissimilar conclusion, just like al-Sa'dī and al-Jazā'irī, al-Shinqīṭi certainly shows his readers other ways of understanding the verses and provides them with a door to either support or criticize his interpretation.

[45]According to al-Shinqīṭī, the majority of Muslim scholars agree that the Prophet's wives had veiled their face even before the revelation of *ḥijāb* verse. Therefore this verse would be meaningless if one understands it as applying only to his wives.

Concluding Remarks

As far as the discussions on some of the issues around *ḥijāb* verses in the three Salafi tafsirs are concerned, one can arrive at a conclusion that these Salafi tafsirs are basically "textualist". Apart from a very limited discussion on *asbāb al-nuzūl* hadiths, they generally ignore the context of revelation and that of interpretation, and instead—in the case of al-Sa'dī's and al-Jazā'irī's tafsirs—focus on what the verses "textually" or "literally" mean or—like in the case of al-Shinqīṭī's tafsir—focus on providing Qur'an/hadith/*uṣūl*-based arguments to support this "literal" meaning. At best one could pay much attention to some of what Saeed calls as the "broad context" of the Qur'an, which also includes the overall content of the Qur'an,[46] in al-Shinqīṭī's *Aḍwā'*.

Nonetheless, though they essentially ignore the socio-historical contexts of the Qur'an in interpretation, Saeed's complete definition of textualism cannot fully be applied to all of these tafsirs since "*Taysīr*'s and *Aysar*'s textualism" neither overtly reflect much reliance on hadith nor approach the question of interpretation strictly from a linguistic perspective. Their textualism might be better described by another of Saeed's distinctions between the two forms of literalism, namely "soft" literalism and "wooden" literalism,[47] assuming that the latter can aptly describe this kind of textualism.

Above all, this kind of textualism or ignorance of the contexts in Salafi tafsirs might be attributed to their emphasis on the "generality" of the text (*'umūmiyyat al-alfāẓ*)—which is very noticeable in the interpretation of *ḥijāb* verses in al-Shinqīṭī's *Aḍwā'*. For Salafis, the text is considered to have superiority over the context. As is the case with many textualists, they focus more on "direct meaning" than "indirect meaning",[48] and treat the Qur'an more as "language" than as "discourse" (language in context).

While *Adwa'* might not be fittingly characterized "authoritarian" (at least "less authoritarian") as it shows the readers different interpretations of the text despite arriving at a dissimilar conclusion regarding the prohibition of gazing at an "unrelated" woman's body and the obligation of *ḥijāb*, *Taysīr* and *Aysar* seem to be more exposed to Abou El Fadl's "authoritarian/authoritative"

[46]See Saeed, *Interpreting the Qur'an*, 105. His distinction between "broad context" and "narrow context" is fairly comparable to Bint al-Shati's distinction between *al-siyāq al-'āmm* (general context) and *al-siyāq al-khāṣṣ* (specific context).

[47]Saeed, *Interpreting the Qur'an*, 113. "Soft" literalism emphasizes the literal meaning and makes it the basis for the exploration of the whole meaning of the text, while "wooden" literalism is "a rigid understanding of the literal meaning of the words without any regard to the complexities associated with meaning."

[48]For this distinction, see Saeed, *Interpreting the Qur'an*, 105.

criticism. Both tafsirs do not allow the reader to know other possible understandings of the interpreted text. There is a high degree of what Saeed terms "rigidity"[49] in these two tafsirs as both attempt to limit the meaning of ethico-legal text to one. Though, this might also be said of *Aḍwā'*—as is also the case with many modern textualists—which still contains rigidity since it—to borrow Saeed's words—"argues against the legitimacy of other possible meanings of the same text."[50]

The "authoritarian" nature in at least some of Salafi tafsirs to some extent might be attributed to their stated aim to "unite" the umma under a single, correct (and "simple") interpretation. However, from the critics's viewpoint, this surely means an act of "locking" the Divine Will. *Wa Allāh a'lam.*[]

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[49]Saeed, *Interpreting the Qur'an*, 104.

[50]It might be important to stress that their rigidity is much higher from some exegetes whose tafsirs many Salafis would consider as parts of Salafi tradition, such as al-Ṭabarī and Ibn Kathīr. This difference is also apparent in the interpretation of al-Nūr [24]: 30-31. See al-Ṭabarī, *Jāmi' al-Bayān*, vol. 9, 303-307; Ibn Kathīr, *Tafsīr al-Qur'ān al-'Aẓīm*, vol. 10, 212-225.

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